PREFACE

I started writing these instructions in 1994 when Bruce Bartlett of the Australian Poultry magazine insisted that I needed instructions to go with the incubators that I was building to sell. I had been building incubators for a couple of years and gave no thought to writing any such a thing because “everybody knew everything there was to know about chooks”. But as it turned out this was not so, and with great effort I had overcome my dyslexia and produced three pages of notes. Little did I realise that there were many questions unanswered and there are still more to answer and I guess there will be more in the future. So here I am making the seventh edition of additions using the box full of notes that I have made after talking to people and making careful observations around the chook sheds over the last five years. Not that I forgotten the information, it’s more that I have not thought that they might be of interest to other people until prompted by customers questions.

It is rare that someone comes up with something new in the chook world, so nearly everything written in these instructions has possibly been said before. And will probably be said again. Not that it matters if it is new to you, and you can use the information. Like anything written in black and white, take it with a grain of salt because what works for me may not work for you. Always remember that chooks are not machines and like all animals will continually present new problems to solve.

Often there may be little or no scientific proof for many of the observations that poultry keepers make, but they are never the less valid ideas and are worthy of consideration.

What these notes are about is to help you to enjoy successful hatching and rearing poultry. It is important to me that you have a positive outcome when using the Smart INCUBATOR that you have purchased whether it is new or second hand.

Each incubator has been individually made, usually for the person who placed the order.

The main distinguishing feature of the Smart INCUBATOR is the large ambient temperature range in which it can hold its set temperature and successfully hatch eggs. The design has been formed from ideas that have mainly been borrowed, repurposed, reused, recombined and where ever possible used off the shelf parts. The others bits I have had to manufacture. Several years of testing and modification followed until success resulted. During this time, the father in-law would often jibe me about how I was slow cooking the eggs that didn’t hatch. I rose above that, to work out what was important to hatch chook eggs. Observation and perseverance is the way forward to being successful.

If you want to sell or show birds you must have the reproduction and raising chicks down pat. There are many successful ways to raise birds. I have presented one of them, that is mine!

Some very good advice given by the late Ivan Gillard goes like this:-
Do take care to limit the number of chicks that you hatch. Sometimes less can lead to more. Work out what you can adequately afford to raise, what is the pen capacity you have when it comes to sorting out what has been hatched. Also assess the time that you have to do the husbandry work required to raise healthy birds and maintain rewarding relationships with the people you live with.

Have a way of disposing of unwanted stock, be it sale to a dealer or at the farm gate, by auction or food for the kitchen table. The reason I produced “How to Dress a Chook for Dinner” was to help people kill and dress birds for the kitchen in a competent and efficient way. Smoking the dressed chooks is a good alternate way of preparing the birds.

Throughout these notes I have made reference to some of the many excellent articles in Australasian Poultry which are available from the Poultry Information Publishers as back issues.

Do enjoy the relaxation, and the joy of having chooks as part of your life and the friends you make on the way.
I have been selling incubators for 25 years and don’t expect to keep going much longer.

Laurie Smart 2019.
## TABLE OF CONTENTS

**SETTING UP THE INCUBATOR** ................................................................. P4
**INCUBATOR SETTINGS FOR VARIOUS TYPES OF BIRDS** .................................. P9
**EGG SETTING CALENDAR for when February is not in a leap year** .......................... P10
**EGG SETTING CALENDAR for when February is in a leap year** ............................ P11
**TEMPERATURE CONVERSIONS FAHRENHEIT TO CELSIUS** ............................. P12
**TEMPERATURE CONVERSIONS CELSIUS TO FAHRENHEIT** .............................. P13

### OPERATING THE INCUBATOR

1. Genetic ability to reproduce ............................................................................ P14
2. Good diet for the hen and cock ....................................................................... P18
3. Temperature control ......................................................................................... P20
4. Clean eggs the way to go .................................................................................. P23
5. Fresh air exchange ............................................................................................ P27
6. Turning the eggs ............................................................................................... P28
7. Humidity in the incubator ............................................................................... P29
8. Egg candling ..................................................................................................... P32
9. Hatching the eggs ............................................................................................. P35
10. Trouble Shooting Egg Hatching ...................................................................... P37
11. Clean the incubator ......................................................................................... P40

### RAISING THE CHICKS

a) Caring For Chicks ......................................................................................... P42
b) Vent And Tail Picking .................................................................................... P47
c) Vaccination Of Chicks .................................................................................... P49
d) Selecting The Next Generation ....................................................................... P50

### LOOKING AFTER THE CHOOKS

a) Every Day Around The Pens ........................................................................ P51
b) Catching Birds ............................................................................................... P52
c) Having Dogs Around Chooks ......................................................................... P54
d) HOW TO OPEN A FEED BAG ...................................................................... P56
e) HOW TO MAKE A WATER DRINKER FOR CHICKS .................................... P57
f) HOW TO MAKE A FEEDER ........................................................................ P58
g) HOW TO MAKE AND USE A BROODER FOR UP TO 25 CHICKS ................ P59
h) HOW TO REMOVE MANURE KNOBS FROM CHOOKS FEET .................... P60
i) HOW TO SMOKE A CHOOK ....................................................................... P61
j) BUILDING A CHOOK HOUSE ....................................................................... P62

### BEHAVIOUR OF CHOOKS

a) Their Behaviour In General .......................................................................... P66
b) The Laying Patterns Of Pullets Is According To What Month They Are Hatched P67
c) Pecking Order ............................................................................................... P68
d) Broody Hens ................................................................................................. P68
e) When Cocks Are Aggressive To People ........................................................ P68
f) How To Hypnotise A Chook .......................................................................... P69

### VERMIN TO CHOOKS

a) Fox Facts ....................................................................................................... P70
b) Rodents ......................................................................................................... P71
c) Hawks Crows & Sparrows ............................................................................ P75
d) Lice Mites & Worms ..................................................................................... P75

### TROUBLE SHOOTING THE INCUBATOR

a) The fan stops or is not operating correctly .................................................. P76
b) The thermostat stops working ...................................................................... P83
d) How to modify the incubator to hatch reptiles ........................................... P85
e) The Circuit Diagram For Smart Incubators ............................................... P86

### BOOKS ABOUT POULTRY

......................................................................................................................... P87

### SOME INTERNET SITES OF INTEREST

SOME HANDY CONTACTS ON POULTRY STUFF ............................................. P88
**SETTING UP THE INCUBATOR**

**Position** the incubator on a reasonably level solid surface. Next to the incubator have bench space to load and unload full trays of eggs when required. Check that all the packing has been removed and that the fan can rotate freely. Don't place the incubator where the sun can shine directly onto it and cause over heating in the unit. Likewise, avoid placing the incubator in a draft as the chill factor they create can also be a problem, particularly at night when the temperature falls. Be aware that hatchlings chirp and can keep people awake during the night if the incubator is within earshot of a bed. So I don't recommend incubators in bedrooms as the hatching chicks make a fair bit of noise and will disturb your sleep.

There is a surge protector built into the incubator but a second will substantially increase the protection to the unit. It is recommended that incubator power cord is plugged into a surge protected power board that has switches. If a power surge occurs the incubator thermostat can be repaired Power boards have a high fire risk to regularly feel the board for temperature, a warm one should be replaced as soon as possible.

A supply of fresh air is essential. If the room smells stuffy then there needs to be more ventilation in the room. The Smart INCUBATOR will operate satisfactorily almost anywhere, even in a garden shed. It is a good idea to use the heat from the incubator to heat a room or shed such as the brooder room or laundry or as one customer has done, in the toilet "so that it wasn't cold in the middle of the night". And there is the added advantage of turning the eggs each visit.

Insert the "L" shaped thermometer into the 10mm thermometer hole in the top of the incubator (about the middle towards the front). Any correction to the thermometer for the correct reading of the temperature will be on a tag attached to the end.

The thermometer supplied will be graduated in Fahrenheit because the graduations are closer to each other and it's easier to remember 100°F as being very close to the required temperature of 99 3/4 °F and is close enough.

The average power consumption in a room temperature of 20°C is about:-

- 2½kW per day for the 81 egg model
- 4kW per day for the 162 egg model

The warmer the room is in winter the cheaper it is to run the incubator. Keep in mind an incubator in a room temperature of 20°C (68°F), will cost half as much to run when compared with running an incubator in a room temperature of 10°C (50°F). Whereas in a room that has ambient temperature of 30°C. (86°F) the running costs will be reduced by about half.

The power rating on the label of the incubator is the maximum power that is drawn; during most times it will operate at about a fifth of that power.

Do take care with brooding heaters as costs can runaway and exceed the cost of running the incubator.

When the incubator is operating the orange or red indicator light on top will come on, when ever the heating coil is heating. Leave the incubator closed for 2 hours to allow the temperature to stabilise. **It is normal for the indicator light to flicker erratically when the incubator has reached its' operating temperature.** On cold days it will stay on longer and on hot days it will be hardly on at all. There maybe a small drop in temperature on a very cold night, don’t chase the small changes as there can be a change of up to ±0.8°F (±0.4°C) with absolutely no problems. The incubator will be normal the next day.

Before the incubator is dispatched it will have been test operated and set to 37.6°C (99¾ °F) with empty trays. So after loading the incubator with eggs it may run a little cooler (½°F or so) for about 24 hours until the eggs warm through to the set temperature. Loading the incubator will alter the air flow...
and this may have altered the temperature setting slightly, and a small adjustment may be required on the second day after warming the cold eggs.

The temperature is adjusted by using a small screwdriver and rotating the slotted screw above the yellow "Temperature Control" label on the top LHS of the incubator. Turn clockwise to increase temperature. The controller's adjustment is approx 1½°C (3°F) per turn i.e. 5 min of angle on the clock ≈0.1°C (¼°F). The temperature controller has a total of ten turns providing a range from approx 30°C to 45°C (85°F to 115°F). Once the temperature is set it may vary by about 0.1°C (0.2°F). This could be more on a very cold night, but will need no adjustment as it will not affect the hatch.

In the extremely hot weather when the room temperature goes over 35°C put ice in the water tray so the incubator can control the temperature. Ice blocks made using water in the plastic containers from butter or margarine in the freezer are fine.

If there is a light switch on the top of the incubator it is for an internal light. A standard bayonet type pilot or fancy round or LED globe is used. It can be left on for extended periods of time if desired.

The ventilation of the incubator is set to operate at 6 changes of air per hour, with the air exiting from holes in the middle of the top. The inlets for air are holes at the centre of the sides about 100mm up from the base as well as the gap around the door. It is advisable to leave any unused egg trays in their place in the incubator to assist with air flow control.

The larger water tray supplied works well in the incubator and gives an average of the ≈40% humidity. Just what is needed for most eggs in the Smart INCUBATOR. All the water needs to do is cover the bottom of the tray, the depth of water will not change the humidity as it is the surface area of the water that controls the % humidity, so it is not necessary to always keep the water tray full. The incubator will consume about a litre of water a day. Filling the tray can be done by using a plastic watering can same as those used in garden. They are just the ideal thing to fill the tray and not spill water anywhere. The added water can be at room temperature, i.e. there is no need to add warm water as the action of evaporation to create humidity has a cooling effect on the water. This means that the water in the tray will normally feel cold. If it is required to increase the humidity during hatching use the second smaller tray, this will increase the humidity to ≈55%. As it is normal that there is more than one hatching date, the slight increase in humidity for a short time will have little effect on the other eggs that are due to hatch at a later date. If the water tray dries out it is no big deal, I have had chicks hatch successfully in an incubator with no water in the water tray. Just top it up when you turn the eggs all will be OK. Because of the air exchange, expect that the incubator will use about ½ to 1 litre of water a day. Use tap water and if you have a disease problem with the added water it can be disinfected by adding a teaspoon of White King (sodium hypochlorite).

A hatching tray can replace the smaller water tray when the normal humidity is OK.

Putting a piece of cardboard over the floor of the incubator will assist in the cleaning the incubator.

There are two types of egg turning:-

1. The 81 hen/bantam egg tray that tilts the eggs 90°. In these the eggs are placed with the big end which has the air sack up, and the pointed end down. One egg is accommodated in each position of the rack. Place the first setting of eggs in a central row going from front to back, this will hold the tilting mesh in place. When possible leave a vacant egg space in the front of the middle column to make it easier to move the turning wire. If the hatch is not even over the tray, rotate the tray 180° twice a week.

Put the tray that is hatching on the bottom level so any dribbles and egg particulars do not fall on the clean unhatched eggs.
A piece of cardboard can be cut to a neat fit and put on the floor of the incubator under the water tray, this and the water tray will catch the dribbles and shell debris making cleaning the incubator floor easier.

When lifting trays of eggs grab the tray by the middle of each side so that it does not twist an pop the turning mesh.

The eggs are turned (tilted) by pushing or pulling the wire mesh from front to back. This means that the individual eggs are not touched during turning, reducing the chance that bacteria from your hands infecting the eggs.

2. The other type of tray rolls the eggs and it consists of wire racks that fits into the 81 hen / bantam egg tray. They are suitable to use with or all types of eggs particularly those that are difficult to hatch, such as duck, turkey and goose eggs. For an egg to hatch the blood vessels in the membrane next to the egg shell need to grow all around the inside of the egg. For some unknown reason this is more strongly promoted by rolling. Tilting seems to work OK with Runner Ducks and maybe others, it’s worth a try.
Duck eggs can be tilted but the information I have seen requires that it must be done at least five times a day to get good results.
I have also been told that Cayuga duck eggs can hatch successfully when tilted on their ends provided that each one is rotated ½ a turn around the long axis once a day.
Many people have told me that spraying duck and goose eggs at each turn on the last week improves hatching. I don’t bother and still get about a 60% hatch with good eggs.

The **48 egg duck rolling wires** consist of ½" X ½" (12.5mm X 12.5mm) square weldmesh which is laid on the dowels of the chook egg tray, with the upper most wires running from back to front to give a smooth rolling of the eggs. The green wire tie goes to the front and up, this is to make it easier to remove and indicate the way up.

The tray is viewed from the side to show the eggs lying on their sides for rolling. To roll the eggs the wire rack is pushed or pulled.

A similar process is used with the 42 egg turkey wire, and the 20 goose egg wire.

The tray is viewed from the side to show the eggs lying on their sides for rolling.

This is a 20 goose egg rolling wire.

It’s normal to hatch in the turning tray. Some people use a second incubator to hatch the eggs in so that the main incubator is kept clean and free of dust.

To keep tabs on hatching dates of eggs
Write the "day due out" (i.e. a number from 1 to 31) on the big end of the egg with a 5B grey lead or a chinagraph pencil, (marking pens have ink solvents that seem to upset and kill the embryo particularly if they use xylene as a solvent). This method of recording will allow you to easily add eggs whenever you wish and still keep track on what is happening in the incubator. You can readily see when a egg has gone past its hatch date and feel confident of when to remove the duds after a hatch. It would be prudent to candle the remaining eggs in case the dates have been mixed up, it wouldn't be the first or last time that it has happened.
The 25 is the day the eggs are due to hatch

The eggs are turned (tilted or rolled) at least twice and preferably three times a day. Don't regiment yourself, do it when you get up, dinnertime, and before bedtime, whenever they occur is just fine.

A few extra turns on the first three days of incubation can improve the hatch rate by about 5%. After that period if a turn is missed no great deal it will make very little difference to the hatch rate. Some test have shown that there is little gained by turning the eggs during the last 10 days. So missing a day or two is no big deal. There are no problems created by turning the eggs on the last days (day 20 & 21), in fact I believe that may slightly increase the hatch, so eggs can be set weekly and not upset previously set eggs.

Always take a good sniff when you open the incubator, and this will allow you to pick up infected or rotten eggs quickly by candling the eggs. Ladies are far more sensitive at detecting foul smells than men, and are 2 to 3 days quicker at picking the offending egg. What to look for is, there may be a cracked egg shell, or the egg could be weeping goobie globules (usually a yellow-brown colour)

Candling will also help detect the infected egg because it looks abnormal, usually the shell is discoloured, the air cell does not have a clean edge, and the shadow is not normal. See the section on candling eggs.

The hand turning of the eggs also allows for the close monitoring of the hatching pattern of a hatch as well as a temperature check, you will learn to feel if the temperature is not right.

In the second and consequent use of the incubator there may be a burning smell when the incubator is first connected to the power. Very much like the smell of a radiator heater when it has been plugged in after being stored for some time. This is OK because it is due to some feather fluff caught in the heating coil, and it should clear in a couple of minutes.

Unfortunately the fan bearings don’t last forever, and need to be replaced when they become excessively noisy (squealing) or when the fan stops operating. When this happens the temperature suddenly drops to about 90°F (32°C) This usually happens after about seven years

On extremely cold evenings the incubator temperature may drop 1°F (½°C) just leave it and get a good night’s sleep all will be OK the next morning.

On extremely hot days put water in both trays and if over 35°C add ice (use butter containers to pre freeze water)

In the event of a power failure the eggs will go into a suspended animation and will generally be ok for about 6-8 hours maybe up to 12 hours.

The incubator can be connected to a portable generator; the VA (wattage) of the generator will need to exceed the wattage (W) of the incubator. For example a 162 egg model will have a maximum power consumption of 700W and the generator will need to be a minimum output of 750VA (or Watts).

In rare event that hatching chick gets stuck with the hock jammed through the wire mesh, gently ease the hock down until the foot comes through the mesh. The chick is the able to be pulled up free of being caught in the mesh.

On the left hand side of the top of the incubator near the two bolt heads is stamped the year of manufacture.
### INCUBATOR SETTINGS FOR VARIOUS TYPES OF BIRDS

<table>
<thead>
<tr>
<th>Type of Bird</th>
<th>No Days</th>
<th>Dry Bulb</th>
<th>Wet Bulb</th>
<th>% Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large fowl</td>
<td>21</td>
<td>99¾F</td>
<td>37.6C</td>
<td>79F</td>
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<tr>
<td>Bantam fowl</td>
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<td>99¾F</td>
<td>37.6C</td>
<td>79F</td>
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<td>Guinea</td>
<td>27</td>
<td>99¾F</td>
<td>37.6C</td>
<td>79F</td>
</tr>
<tr>
<td>Pea</td>
<td>28</td>
<td>99¾F</td>
<td>37.3C</td>
<td>79F</td>
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<td>Duck</td>
<td>28</td>
<td>99¾F</td>
<td>37.6C</td>
<td>84F</td>
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<td>Muscovy</td>
<td>35-37</td>
<td>99½F</td>
<td>37.5C</td>
<td>85F</td>
</tr>
<tr>
<td>Quail - Coturnix (Jap)</td>
<td>17</td>
<td>100F</td>
<td>37.7C</td>
<td>85F</td>
</tr>
<tr>
<td>Quail - Bobwhite</td>
<td>23-24</td>
<td>99¾F</td>
<td>37.6C</td>
<td>85F</td>
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<td>Turkey</td>
<td>28</td>
<td>99½F</td>
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<td>50</td>
<td>97½F</td>
<td>36.4C</td>
<td>78F</td>
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</tbody>
</table>

Note: - 1. That the temperature tolerance range is approximately ±0.4°C (±0.8°F) for the whole of the setting time for fowl, short times of variations are ok.

2. It appears that modern game bantams hatch better at a slightly lower temperature 37.5°C (≈99.9°F) ref Ian Simpson 03 58211269 PSBEV Journal Feb 2014 P36

3. Bantams tend to take 20 days to hatch.

4. Pheasants are sensitive to the incubator being opened during hatching time. Also Ref Aust Poultry Vol 10/1 p20 The Incubation of Pheasant Eggs. I have been told they hatch better at 37.7°C (99.9°F)

The next two pages are EGG SETTING CALENDARS (non-leap and leap year) that can be copied and used to determine the date when the eggs are due to hatch by moving from the date of setting the eggs down the column three rows for chooks and four rows for ducks to get the hatching date.
### EGG SETTING CALENDAR for when February is not a leap year

<table>
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<th></th>
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**EGG SETTING CALENDAR** for when February is in a leap year
### Temperature Conversion Chart

**FAHRENHEIT to CELSIUS**

\[( ^\circ F - 32 ) \times \frac{5}{9} = ^\circ C\]

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OPERATING THE INCUBATOR.

There is a narrow range of requirements for successful incubation and it differs slightly for each type of bird. Refer to the setting chart.

Fundamentally, what is required to successfully produce chicks using an incubator is a combination of:

1. Genetic ability to reproduce.
2. Good diet for the hen and cock.
3. Incubator temperature control.
4. Clean eggs.
5. Fresh air exchange.
6. Turning the eggs.
7. Humidity in the incubator.
8. Egg candling.
9. Hatch the eggs.
10. Trouble Shooting Egg Hatching
11. Clean incubator.

Each of these requirements can vary within limits, and if you can comply within them, there is no reason that you can’t hatch at least 80% of the fertile eggs.

What you can expect is that during spring about 30% of the eggs are infertile. That leaves 70% good ones, and 80% of those to hatch, that is 80% of 70% = 56% produce chicks (0.80X0.70=0.56) i.e. about 7/12 of the eggs set to hatch. Any more than that is a bonus, sure I’ve had 12/12 hatch but I don’t worry until it is below 6/12, and at 3/12, I would panic and consult the trouble shooting section to find a way of improving the situation.

With quail a hatch of 50% of eggs set is normal, and they all hatch within an hour or two then no more will hatch.

\[
\text{% Fertility} = \frac{\text{Number Fertile}}{\text{Total Number of Eggs}} \times 100
\]

\[
\text{% Hatchability} = \frac{\text{Number of Chicks}}{\text{Number of Fertile eggs}} \times 100
\]

1 Genetic Ability To Reproduce

This is one thing that an incubator cannot change, if a bird has lethal genes this could cause the chicks to die in the shell. Other problems include low egg production, inability to mate, low sperm count (this varies throughout the year and is much lower in the middle of winter), ageing birds (female run out of ova to make eggs), also females rejecting the male and males having a favourite hen. There can be a low fertility in a line of birds. The older cocks may not be fertile until spring/early summer. Often the long spurs of older cocks interfere with the mating process. To shorten long spurs on old cocks slowly twist the end of the spur and it will fracture and the end portion will become loose and can be easily removed. Otherwise use a 100mm hand grinder to cut off the spurs about 10mm from the leg. The grinder will seal any blood vessels severed as it cuts. A male deprived of water for 48 hours will reduce his sperm production for up to six weeks. When changing a mating it is better to move the cock rather than the hen who can be put off laying by a change of scenery. It will take two days for the new mating to come through to the eggs, but to be sure leave it for a week.

Feathers around the vents of both the sexes will hinder the joining process. Remove the feathers about two to three cm around each vent by pulling the feathers out. Do not cut them as the stubble will cause pain to the cock defeating the purpose of clearing the way for vent contact. As hens age the number of eggs they produce each year diminishes until their ovaries simply run out of egg follicles. Some exceptional birds can lay a reasonable number of eggs at seven years; but most have finished after three years. What you can expect in the wild is that all natural reproduction will replace one pair with another pair or maybe two over their lifetime. Any extra is a bonus due to good husbandry and one hundred youngsters from a hen is not out of the question.
In autumn usually the only eggs available are pullet eggs, they are not conducive to easy hatching because the small eggs do not exchange the carbon dioxide and oxygen gases readily. Combine that with the cocks who are usually have a low infertility in winter a poor hatch is normal. If you want set pullet eggs wait until they have been laying for about a month so that the eggs are big enough to develop a good air chamber so the carbon dioxide can be excreted.

Ref Aust Poultry Vol21/3 p25 What is the Air Cell?

An alternative is to use lights in the morning before dawn to extend the day light to more than 12 hours to entice hens to lay. Afternoon light extension could upset the birds perching for the night when lights go out and it suddenly becomes dark.

Ref Aust Poultry Vol21/3 p26 Lighting Your Birds.

One important thing to select for, is the egg laying ability of the hens, without eggs it’s hard to produce chicks. A good bit of advice given to me by an old timer was to set eggs from two + year old hens that lay regularly to maintain a flock that has strong egg laying ability. He really cherished a 6 year old hen that he had when it laid over 150 eggs in that season but he had no qualms about disposing of 3+ year old hens that did not lay enough eggs. It is normal for birds to lose 30%+ of their laying capacity each successive year so after 3 years they are laying about ¼ of their first year capacity.

Any extreme of climate temperature, too hot or too cold will slow egg production.

Inbreeding can produce a line that is either strong or weak in reproduction. If it is weak, the line will die out unless some new blood line is imported to strengthen the line and cover the weakness. Sometimes a line becomes a dud and it’s time to cull and start again or bring in a new blood line. On the other hand, a strong line can be weakened by out crossing and they might be better off left alone. So I only an outcross to correct some defect, and then only with great care over several generations. Hasten slowly to be sure that the progression has the quality you desire. It is prudent to run two lines of birds in case the new line from the out cross falls into some serious problems. Use toe punching to distinguish the new line.

A good way of getting a quality out cross is to search interstate for a top breeder of the desired breed, they will probably sell eggs at the end of their setting season. Have the eggs wrapped in bubble wrap and sent by overnight parcel post; it is the quickest way to travel the eggs. Expect to hatch about 20% to 30% out of the eggs any more is a bonus to be thankful of.

While selecting breeding birds try to improve the whole of the bird type. Apart from show qualities consider laying ability and don’t forget to look at the birds’ behaviour, disease resistance, and body structure.

The way forward is to work on one fault at a time. That is, it could take many years to breed a good show chook. Another way is to buy the best bird you can find and the money spent is a good investment.

When purchasing chooks look for the features that you don’t have and that you need in your flock. And don’t expect to have the best birds that the vendor owns to be offered for sale. You will be offered culls, they might be good culls, but never the less culls that have some sort of fault. Ask what fault the bird being offered has got, most breeders will be forth coming and honest.

The genes of one pair of birds are so diverse that it would take about 70 years to exhaust all the possible breeding outcomes from that pair of birds. There many good books on genetics refer to the list of books at the end of these instructions.

Ref GOOGLE Basic Breeding Principles

When recording on the eggs use a 5B or 6B grey lead pencil both of which are soft,
non toxic and durable. Many marking pens use a toxic fluid as a solvent that puts the egg embryo at risk and a poor hatch is usually the result. A sharp pocket knife is almost an essential piece of equipment to sharpen pencils clean eggs open bags cut hay band and many other odds and ends.

Record on the narrow end of each egg from where the egg came from. Use the small end of the egg for notes because that is the end which usually remains intact after the chick has hatched out telling you where the chicks came. Whereas during the hatching process the big end of the egg is often broken, leaving the notes on the small end intact. Use the large end to record the hatching day of the egg in the incubator. This is because it is the big end which is up in the incubator and is the most visible place to put the day of the month (1 to 31) that the egg is due to hatch. This allows you to easily see whether an egg has past it’s hatching date and when candling how many days it has been set. If the pencil breaks through the shell when writing discard the egg for hatching, it probably had too thin a shell to hatch any way. If your desperate use o drop of PVA glue to seal the hole. When this happens frequently, what is required is to provide more usable calcium for the birds. This can be in the form of shell grit in the pens, or if mixing a mash formula add ½ a hand full of finely ground beige garden limestone in each bucket of feed (the fawn coloured KURDEEZ LIME crushed garden lime (not the corrosive white hydrated lime used by the building trades)

NB no shell no hatch similarly cracked eggs are useless except for food, I have never been able to exclude bacteria and moulds from a damaged shell.

It has been noted that when the drug sulphonamide is given to hens they lay soft shelled eggs

Each hen lays its’ own shape of egg and with a little skill the eggs and chooks can be correlated.

Store the setting eggs in ice-cream containers or egg cartons with the small end down (the latest research recons that the pointed end up). Do that in a room temperature between 5°C (40°F) and 20°C (68°F) for no longer than 10 days. Eggs stored at too low a temperature kills the embryo while too high starts the slow development of the embryo. If you have trouble storing the eggs below 25°C it may be better to put them in the incubator to hatch even if it is an odd time.

During winter be aware that eggs that have been subjected to an overnight frost may have been made infertile. When eggs older than 10 days old are set they are slower developing, hatch late and usually sticky when they arrive. Sticky chicks can be rinsed in warm water and returned to the incubator to dry. Or just left in the incubator to dry out over 24h.

If you want to identify the birds hatched from particular eggs then separate them at about 2 days before the eggs are due to hatch, by tying them into mesh bags or use open weave plastic baskets with about 70mm sides. The net bags that oranges come in are excellent to restrain about 6 eggs at a time. If required the whole bag with the eggs inside can be turned. Place the bag of eggs on the egg tray or the floor of the incubator next to the large water tray. Normally only the large tray is needed for humidity.

This is an example of using a mesh bag. A bulldog clip can be an alternate way to hold the bag closed.
An alternative is to use a separate shelf in the incubator or another incubator that is used only for hatching. Another alternative is to use plastic baskets placed in the incubator as per photo.

These baskets are available at SPOILS stores at the princely sum of $2.

The baskets can be placed in various positions.

After the eggs hatch, the group of chickens can be permanently distinguished by toe punching.

N.B. toe punching is only done in the first few days in the life of a chick. When you toe punch the pin is placed on the top of the web. Make sure that you remove the plug of skin that is punched out, otherwise the hole can heal over and all the effort to track the birds will be lost because the plug can heal back and be indistinguishable.

One breeder told me he cuts the web because of the hole growing over making the toe punching useless.

This a toe punch that is 20 years old! They are generally hand made and expensive but it will last as long as you keep it from disappearing. The cutting pin can be sharpened by twisting the two sides around and using an oil stone.

Attach something bright like ribbon to the toe punch so that you can find it easily after it has been put down.

There are 16 combinations of toe punching using the 4 webs between the toes. Note the patterns. The combinations can be repeated with each breed.

This is how a toe punched foot looks like on an adult bird.
Toe punching, will help in keeping track of what was successful and what was a problem when they have grown into adults. This can help you breed more efficiently. There is only one catch, you will need to keep a written record of what, where, and when otherwise the toe punches will have little meaning. I use the calendar that I have in the incubating room. Because toe punching is painful to the chicks I do as little as possible.

Some people cut the web with scissors because they have had problems with the hole growing back.

Ref Aust Poultry Vol 11/4 p5 How to do Artificial Insemination

Ref Aust Poultry Vol 10/2 ;p19 Care of Hatching Eggs.

2. Good Diet for the Hen and Cock.

A poor diet can reduce fertility to as low as 40%. This means that if 80% of these hatch, this would yield about 3/12 from the set eggs. Quite often an embryo in an egg will die in the last three days because it has run out of some nutrient or vitamin that has not been packed in the egg for the chick by its mum.

The combination of free-ranged pick with supplementary commercial feed such as layers or breeders pellets will usually fill the birds diet needs, making it possible to hatch 100% of their eggs (it doesn't always happen but it is possible). If however you need to continually pen the birds, then use a breeder's ration. If you have time like most old people do, supplement it with chopped up kitchen scraps into pieces of about 10mm x 10mm x 20mm. Green feed such as silver beet, grass cuttings or bright green Lucerne chaff (Cramer’s Chaff) and include calcium in a useable form such as sea shells, Kurdeez fawn coloured garden lime or crushed egg shells (there is no evidence that it encourages egg eating).

Almost any food scraps will add to variety and interest for the birds. But please no tea bags with strings, the string can get caught up and garrotte a bird’s leg. Be sure to only use cooked meat. Potato is usually preferred by the chooks when cooked. Also lemon rind, watermelon skins, the coarse storks of silver beat, cabbages, and banana skins are all the go when cut across into small pieces about 10x10x20mm. Not too much bread and cakes, and then best in a damp or wet state. Chooks draw the line at dry onion skins all they do is to add to the pen litter. Grass cuttings from a mower that exhausts its fumes onto the cut grass are not to be relished because the oil residue does not make them very appetising. Birds that do not have access to sunshine will require the necessary vitamin D & E, in a supplement. There exist many, such as ‘Stockgain’ & ‘Molavite’ which have molasses as a base, others such as ‘Prophama P92’ are in powder form and can be added to the feed mix.

Normally birds will generate sufficient vitamin D from the oils on their feathers when preening after being in the sun. This one good reason to face pens to the north to allow the winter sun into the pens, another is the warmth they receive which reduces their food intake.

If feeding out dry be careful to make sure that water is always available, as birds need water to eat and process dry food so they will drink more water. Particularly when young.

Also, too much barley is one factor that is believed to cause a markedly reduced fertility. I have been told that a commercial egg producer changes the birds feed to barley with no water for 2 or 3 days to stop them laying and induce moulting. It appears that any change of diet can put hens of the lay.

Oats have many of the essential proteins for chooks, however because they have barbules the chooks will not be keen on them unless they have been crushed and soaked for about 4 hours. To the crushed oats I add crushed wheat dried peas and...
maize, along with a vitamin supplement also a sprinkle of garden lime all mixed with Lucerne chaff and a vitamin supplement to make a chook tabouli. This can be soaked for about 4 hours or feed dry. Each day I use an XL Chinese scoop (300mL) to measure out one dollop for each large chook or two bantams. The food is feed out at several spots in a pen to allow the birds at the lower end of the pecking order to eat without being bullied. The same diet is feed to all my birds because to me if birds need a special diet for fertile egg production then why not for growing chicks? When feeding a young bird it is the same amount as adult bird and always in the morning long before dark so there is little left for rats. The protein requirements of the birds can be meet by adding some cooked meat. Some breeders give out a can of dog food once a week to boost the protein in the poultry diet. Every old poultry keeper has their own recipe and somehow the chooks thrive. Problems can arise when too much of any one food is feed out to the birds. The amount that is feed out to a pen is guided by the birds consumption, most of the food should be gone in 60 minutes. Otherwise the birds will become obese and lay less. Commercial birds like Isobrowns will stop laying if over feed. (Aust poultry v27/5 p14)

After observing the effects of the quality and variety of the food consumed by the birds has on the hatchability of eggs has lead me to take greater care of my own diet. I eat all my vegetables including the broccoli and carrots but not much maize because I don’t want yellow legs.

Brightly coloured legs and yellow yolks are enhanced by corn, maize, greens, capsicum, paprika, and marigolds free range eggs can lose their colour in summer when the grass dries. Note maize has amino acids that animals cannot make themselves. Don’t feed long fibrous grass or rhubarb skins to chooks unless cut up into 10cm pieces as they can form an indigestible ball in the crop and starve the bird.

Also, be aware that birds like us relish a variety in their diet, eating is an important part of their life. Just watch how they try to hide some scrap of meat from the other birds or eye off chopped up kitchen scraps and savour the flavour of some morsel they have chosen. Using food scraps for chook feed is part of saving our planet. I often have phone calls from people who have purchased birds from me about the bird’s reluctance to eat commercial layers pellets.

Have at least two feed stations to allow timid birds to get a good feed without being bullied.

Chooks given too much good tasty food will turn it into fat not muscle. I check on the consumption of the food offered, and if not eaten after an hour they get less the next day. Another way of checking is when cull birds are killed and dressed for the table look for internal fat around the vent.

There is some evidence that there is a possibility that genetically modified grains can cause infertility, this is yet to be proven.

Stones of the correct size are essential for the gizzard to grind the food completely and the birds to make full value of what they have eaten. The size of the stones required varies with the size of the bird so provide a range of sizes, usually free ranged birds find their own. From inspecting the contents of gizzards, poultry seem to prefer stones 2mm to 4mm diameter. Handfuls of crushed rock or stone dust seems to give them enough choice. Throw a small spade full (2-3 cupfuls) into each pen every 3 months or so.

Don’t risk damaging your back carrying heavy bags of feed. Move food around using wheelbarrows and hand trolleys, that have their tyres pumped up hard for easy travelling.

Ref Aust Poultry Vol4/1 p16 Nutritional Factors Affecting Fertility And Hatchability.
Temperature Control of the incubator.

Temperature control is the most important factor of incubating eggs.

The incubator has been designed and built to operate and hatch eggs in a room or shed which has temperature range of 5°C to 40°C (41°F to 104°F). The cooling effect of the evaporating water for the required humidity in the incubator has a cooling effect and allows the incubator to operate in room temperatures greater than the set temperature (generally 37.6°C or 99¾°F). If the room temperature gets to 30°C (86°F) put water in both trays. Any higher than 40°C (104°F) then put ice into the water tray. A block of ice made by freezing a butter container or milk carton of water and tearing off the carton before placing it in the tray will be a great help to the incubator holding its set temperature on those very very hot days.

I have found that hen eggs can stand a limit of ±0.4°C (±34°F) error from the set temperature of 37.6°C (99¾°F) in an incubator over the whole of the incubation period. Likewise large eggs like emu eggs can tolerate a range of 36°C ±1.0°C (96°F ±1½°F). Generally the smaller the egg, the tighter the temperature range that can be tolerated before a disastrous hatch occurs. Although for a short time of a day or so temperature variations can occur without problems, an incubator operating outside of these ranges for a large amount of time say weeks will produce virtually no hatch.

When an incubator goes over temperature it will take some time to cause the egg temperature to rise and the embryo to overheat and die. That is it can take some time for the egg to overheat.

On the other hand the incubator can be without power for 6 to 8hrs and there seems to be little loss except from the eggs hatching a little late. But longer periods without power requires a generator to maintain the heating of the eggs. Use a generator that has a VA rating greater than the Watt power rating written on the top of the incubator. The set eggs seem to go into some sort of hibernation. What is important is that the set temperature of the incubator is maintained for most of the growing time and the intermittent heating or cooling of the eggs does not seem to affect them.

If you have had a large variation of temperature over a long time and you think the eggs have had it, and you are short of space warm the eggs to the set temperature and open one or two to see if they are still alive, otherwise run them through to their hatching date you never know your luck.

I have no qualms about having the eggs out of the incubator for an hour or two or more, when it comes to candling the eggs or to search for a foul or “off” egg that has been infected by bacteria or to make a repair to the fan bearings.

Some people claim that taking the eggs out of the incubator for ½ hr a day will increase the hatch, and that's all very good, but I couldn't be bothered because I'd forget to put them back in the incubator.

Opening the door of the incubator will not affect the eggs except when hatching, and
even then only sometimes. Normally at those times I open only when necessary, and make sure that the water tray has water. Perhaps even skipping an egg turning during the hatching time may be a good idea particularly with game bird eggs. The reason being that although the incubator will only take 3 minutes to regain temperature, the sharply reduced humidity, may cause some of the egg shell membranes to dry and stick to some of the hatching chicks. When this does happen and the shell has been pipped most of the way round then simply ease the cap of the shell off and release only the head of the chick. If the chick has not emerged from the shell in five hours then break the shell down the back of the chick. Do this because the last thing a chick does before hatching is to enclose the remainder of the yolk with its stomach. This yolk will provide enough food for three or four days.

The best indication that the temperature is correct is when most the eggs come out on time. To the hour. So take great care to record when setting the eggs when they are due to hatch. Even to the hour. This can be done by writing the due hatching day on the large end with a 5B greylead pencil.

The hand turning of the eggs allows for the close monitoring of the hatching times pattern of a hatch as a temperature check as well as that chicks don’t get swashed when turning the eggs.

It is important to have an accurate thermometer that is placed to measure the air temperature of the air that passes over the eggs.

Cheap thermometers can be inaccurate by anything up to 2°C (4°F), the thermometer supplied with the incubator has been checked against an accurate one and any error noted and placed on a tag at the end of the thermometer. If you have broken the supplied thermometer a cheap glass clinical body thermometer can be used to give a good indication of what is the set temperature of the incubator. They are accurate (usually good to ±0.1°C at 37.8°C or 100°F) but will only give a maximum temperature. Because the incubator does not normally over shoot in temperature, they can be relied on to give a reasonably accurate reading. Don't forget that the mercury needs to be shaken down well below 36°C before placing the thermometer into the incubator. Lay it on the middle of the egg tray so that the mercury bulb is free of contact with anything. Shut the door and come back to read it after 20 minutes.

An ancient way of checking egg temperature is to hold an egg against your eye lid a little practice is all that is needed.

A check can be made on a thermometer by putting it into an incubator that is known to be operating at the right temperature. Thermometer manufacturers will without exception accept that the length of a glass thermometer can sometimes change over time and make the odd thermometer inaccurate. Another check can be made by using the thermometer that has been supplied from Smart Incubators and placing it at tray height. These thermometers are made to be correct at 100°F.

Take great care not to crush and break the thermometer when closing the door.

A factor that can cause an inaccurate reading of thermometers is the speed of air passing over the thermometer bulb. As this varies it can cause small variations in the reading by the heating/cooling effect on the bulb (called the wind chill factor). This is often the case with digital thermometers and an inaccurate reading is the result. The nature of the fan motor, is such that it will vary its speed when the supply voltage changes, and this can occur when the
heating coil is on / off, also from night to day. Voltage changes can happen when large motors are run nearby, such as at milking times or when irrigation pumps are run. These changes in temperature are small and will not cause hatching problems. I have often had owners of Smart INCUBATORS state that they have not altered the temperature control over several years.

Normally some chicks will be early and some will be late, but most will be almost to the hour. Eggs older than 10 days may hatch late. Quail nearly always hatch within two hours. However, all this can be a little unreliable when it comes to Emus and some other large species that have a variation of the gestation period of up to three days. I once had a line of poultry whose eggs often took an extra day to come out! So I usually leave the eggs in for the extra time just in case I have made a mistake on the dates. If I have any doubts I will candle the eggs, the viable ones have a sharp dark shadow at the air cell, while the eggs that have stopped growing have a shadow that is gradually getting darker away from the air cell. If in doubt separate these eggs in the incubator to develop your candling skills.

**When there has been a poor hatch**

Observation is important, in deciding if the temperature is incorrect and if incorrect is it high or low?. What to look for is whether all the chicks hatch late and seem lethargic or not at all. They hatch on the dry side and with membrane sticking to them. The very late hatching chicks may be covered in a gluey coating. This will dry out if the chick is left in the incubator. The temperature is low by about 0.2ºC (0.4ºF) per half day they are late. This is rectified by turning the temperature control clockwise angle of about 60º (10 minutes on the clock). It is not normal to get anything to hatch, after an extra 24 hours has lapsed but later hatchings will occur when the temperature is low. A low temperature can result in an inadequate air cell developing and fertile eggs piping but not hatching.

**Eggs hatching early** can be caused by a variety of reasons and a bit of detective work will be essential. Look at the storage of the eggs. Was it too warm? i.e. at above 21ºC (70ºF) and the embryo starts to slowly develop. Did the hens start the hatching by sitting on the eggs during the laying process? Were the eggs collected every day? Was the incubator set at too high a temperature? If it is the incubator the hatch rate will be low; the chicks will be early and be especially active, while there be a few on time, but there will be no late chicks. When this happens the temperature is high by 0.2ºC (0.4ºF) per half day they are early. Turn the temperature control anti-clockwise angle of about 60º (10 minutes on the clock). If however there were some late chicks, then collecting and storage of the eggs will most likely be the problem.

Ref Aust Poultry vol 21/3 p25 What is the Air Cell?

If there is a consistent variation of hatching times over a tray, there may be a small variation of temperature within the incubator and the fan may not be operating at its normal speed (it may be very noisy and need new bearings). Turning the trays around half a turn twice a week can accommodate this and correct the variation. Also move the trays down through the incubation, so the next eggs to hatch are at the bottom level. This is good practice because it will mean that the hatching chicks will not drop stickies and shell debris onto other eggs below them and possibly infecting them. A sheet of disposable cardboard fitted neatly on to the floor under the water trays will make cleaning easier.

On very cold nights, the temperature of the incubator may fall a little, more so if the incubator is in a draft. Do not adjust the temperature until the next day when it has warmed up, and only then with great caution. If it is of great concern the first step is to move the incubator out of any draft (there is a chill factor caused by drafts) to a warmer part of the room. An alternative is to surround the incubator with slabs of polystyrene at night. Another
alternative is to block off one or two of the ventilation holes on top and reduce the air exchange. As a last resort remove the water tray because the incubator is not only heating air but also a large amount of water into vapour. This can be a considerable drain of heat and make it difficult for the incubator to reach operating temperature. Refer to the humidity/vapour graph and consider that at 0°C the incubator could be trying to vaporise and heat 20ml of water per hour (½ a litre a day).

When the bead in the thermometer has separated, don't rely on it until it has been joined together as one. The thermometer supplied with the incubator has a relieving chamber at the high end. These have been specially made so that when they have had a high temperature applied to them the expanding fluid has a space to go to. Consequently they can be repaired instead of them disintegrating by blowing their bulb.

To join the bead, dip the sensing bulb in and out of a cup of very hot water until the bead starts to move. Then wait until the bead stops rising then dip again until the break enters the relieving chamber; flick the end with a finger nail to dislodge the break and join the fluid together. Then allow the thermometer to cool with the chamber end held upper most. It may take several tries and possibly using freshly boiled water placed in a cup to be successful.

4. Clean Eggs is the Way to Go.

You will never be able to achieve aseptic conditions for incubation but being clean can reduce the disease burden on the eggs.

However you can help the natural disease barriers of the eggs, which is the bloom or layer of dried mucus that is placed on the outside of the egg as it is laid. Do this by handling the eggs as little as possible and not interfering with the bloom by introducing any source of moisture e.g. wet fingers, wet bench etc. Thereby reducing the bacteria, virus and pathogens, burden on the surface of the egg. Frosty eggs have no bloom and are unlikely to hatch.

It is good practice to wash your hands, then dry your hands with a towel before going to the incubator. Make it the order of the day to go to the incubator first, then attend the youngest chickens next followed by the older chickens and last the adult birds. If you go back to the incubator wash and dry the hands again.

Clean eggs are a good start, and the best way of getting clean eggs is to prevent them from getting soiled in first place by having clean nesting absorbent nesting conditions.

There are three ways of dealing with dirty eggs.

First and best, is to discard them from setting and use them as food. It is most likely that infecting agents have already penetrated the egg and made them useless for setting. The same goes for cracked eggs, I have yet to hatch a cracked egg, even if it has been sealed with glue they seem to have been become infected before the repair.

Some experts believe that most infected eggs are infected just after they are laid and there is little to gain stuffing around with them.

Second way is if desperation is the order of the day, wait until they are dry then use
coarse industrial steel wool that is soap free (from the hardware store) to clean off the muck it will leave the bloom in tact. Don't forget to always use fresh steel wool and discard the contaminated used steel wool. Another way is to use a spoon or knife to scrape the muck off the egg.

**Third** is to wash the eggs using clean water that must be 12°C (22°F) warmer than the egg. Most papers recommend a temperature range of 43°C to 50°C (110°F to 120°F) any hotter can interfere with the egg's fertility. All I do is run the hot water at a dribble and clean the eggs by rubbing the dirt off with my fingers. Allow them to air dry in a rack or paper egg carton. I usually set them as is, however the commercial people recommend that when dry disinfect them by spraying them with 3% quaternary ammonium (i.e. benzalkonium chloride) allowing the disinfectant to dry on the eggs. By doing this the natural bloom is removed and thereby natural protection reduced, and also requiring a higher standard of hygiene in the incubator.

So a good start is to get clean eggs by having them laid in a clean dry nest. Have the nest boxes in place before the pullets start to lay.

You can't make a hen use a nest but you can make them attractive for them to use rather than the floor of the pen. Make the nests attractive to the birds, they prefer darkness and seclusion for egg laying. Nest size is important. For large birds built the nests about 450mm(18") off the floor. Bantams are happy to have their nests at a higher position, I have my bantam nests about 900mm (3') off the pen floor. Some people place the nest against the front wall so they look dark or on the side so that the eggs are in the shade. Chooks like to have a platform just outside the nest boxes to walk on to check out the nest before entering. Provide one nest for four hens; otherwise, they will use the floor.

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*The nest sizes are 300w x 300d x 300h for light breeds & 350w x 350d x 350h for heavy breeds.*

*I place the nest in the shade at the back of the pen. This means that I must walk through the pen to retrieve the eggs, doing this every day quietens the birds. It's a good idea to have a variety of nests to give the birds a choice females always like to have a choice.*
Having said all that about a slopping roof this 20L plastic with a 150mm to 200mm hole is a quick cheap easy and effective solution for bantams. The 75mm platform in front is essential for the nest to be attractive to the hens. This nest is too small for full size birds.

An old sheet-metal dust bin on the floor of the pen is usually attractive to hens to lay in or just behind the back of the bin. However they must be made with the back end set lower into the litter and made stable so they do not rock and roll when the hens use them. Birds don’t like wobbly nests of any type. Another suggestion is an old milk barrel and I have been told they make excellent nest “boxes”. A spoon on a stick will be necessary to collect eggs from the bin.

Having clean dry nesting materials is essential to get clean dry eggs. It must be an absorbent material so that any moisture from broken eggs or manure is dried quickly and is not likely to contaminate nearby good eggs. Occasionally there are hens that are just plain dirty around eggs and they must have some redeeming purpose in life to retain them in the flock.

Leaving artificial eggs such as golf balls odd painted wooden replicas in nests seems to encourage the chooks to lay in the nests. Make sure that there are perches well above the nest box height so that the birds will not roost in them at night and soil the nests.

Ref to Aust Poultry vol 17 No4 p10 Nests do Matter.

Ref to Aust poultry vol 18 No2 p8 The Perfect Nest.

If however all efforts fail and the hens lay on the litter usually in a corner use a tablespoon on a stick to dig about for buried eggs.

Don't forget the hands that are used to pick the eggs up, they are best being clean and dry that’s difficult when it’s raining. As the eggs are collected, keep the cracked and dirty eggs separate. Last of all, pickup the eggs as often as possible particularly on hot days to prevent them from making a false start on incubating and discouraging hens from going clucky. Also, it will remove the temptation of the chooks playing with them and egg eating or making them dirty. Usually birds eat eggs straight after laying or the shells are very thin and are broken from being pushed about. It is natural for a clucky hen to eat the egg shells after a hatch; similarly, once chooks have learnt to break open an egg there is no retraining them not to do it, as their mind has been permanently altered. As far as chooks are concerned, egg yolk is super delicious. Just hard boil a few clear eggs and chop them up and feed them to chicks. They go bonkers and can't get enough. I don't think that they will associate an egg with yolk later on unless an egg has been broken.
Having said that, I once had a very good cock that I could not get any eggs from no matter which pen he was in, so I rolled an egg in to the pen and immediately he walked up to it and pecked it open and then invited the hens over to feast on the contents. So from there on he was only with the hens for a short visits trice a week to do his job then out into another pen by himself without eggs. The hens never broke any eggs after being separated from the offending cock. If the culprit is a hen they cannot be retrained and disposal is the best solution.

Nests that roll the eggs out of sight and reach as soon as the egg is laid may be a solution.

Another problem of leaving a bunch of eggs in the nest is that it encourages hens to go clucky.

Ref Aust Poultry Vol 10/6 p18 Make Your Own Rollaway Nests

If you put your hand into a nest with a bird don’t make a sudden move but continue calmly and remove the eggs, after a while the birds will not worry about you

Sometimes the nest becomes infested with lice and needs to be cleaned, dusted, and refurnished with clean litter to make the nest attractive to the hens.

Storage of setting eggs

Eggs are a living identity so they must be kept dry at temperatures between 5°C to 20°C (45°F to 68°F) the optimum temperature being 12½°C (55°F). This is to reduce the slow development of the embryo, bacteria and loss of fertility. Store at a high humidity, 70-80% and if you intend to store them more than a week turn them once or twice a day. Turn the eggs back and forth to prevent damage to the internal structure of the eggs which may happen if they are turned continuously in one direction.

A good way of turning the eggs is to tilt their container or egg carton. Eggs can be stored in a refrigerator set at 12°C, but take care as they have a very low humidity, so place the eggs in a plastic bag to maintain a high humidity. Storing eggs below 4°C can kill the embryo. I find storing the eggs for up to a week in plastic ice-cream containers in a cool place such as the floor seems to work OK for me. Allow cool eggs to warm to about room temp before placing them in the incubator, otherwise they could have condensation form on them when placed in the incubator this can damage the eggs’ bloom.

Embryos do not like rough treatment, so don't jar the eggs, particularly in the first 3 days of incubation. Don't tap them together to find cracked eggs. It is good practice to use a Candler to check the setting eggs for cracks and any infection particularly when they come from other people or off the pen floor. The eggs should be totally clear before setting them otherwise be prepared for an egg bomb of infection bacteria in the incubator.

The hatchability of chook eggs decreases to below 70% after 10 days and 50% after 14 days. After that hatchability quickly diminishes to almost nothing. The older the eggs the longer they take to incubate some times taking an extra day or two to come out, only to be lethargic and slow growing.

Game birds and birds that lay small eggs and rosecombs are best set weekly.
Large eggs like emu and ostrich eggs appear to have a much longer storage time than chook eggs and it may take around 4-5 weeks before there is a serious reduction of hatchability.

If I post eggs, I pack them in an egg carton padded with polystyrene shells (that I get from the local bookshop) or bubble wrap and then wrap the egg carton in bubble wrap to reduce travel shock. The cartons are packed into a plastic 5litre storage container that holds two dozen egg cartons which just fits into a 3kg post pack. They are posted in an Express post 3 kg plastic bag so the eggs will be delivered as fast as possible and not age excessively. My experience so far has been that the eggs are not treated roughly, and delivered in less than three days, In generally a reasonable hatch rate is achieved.

If you receive eggs by post and one has broken and spilt its contents on neighbouring eggs, they need to be washed in warm water to remove the mess so it will not seal the shell and prevent the oxygen - carbon dioxide exchange. There are many old people who strongly believe that travelled eggs need to be rested for a day before setting.

Eggs are laid big end first.

Put an egg in your hand and try to squash it. it won’t break (unless you are wearing a ring). As a kid I once read that you could throw an egg over the house as long as it landed on grass it wouldn’t break. Well the ones that landed on the grass were ok, but the others that landed on the concrete paths had difficulty remaining in one piece. The aerodynamics of the egg are such that it would land big end down. Mummy was not impressed at our scientific experiment that destroyed a dozen eggs and left a mess on the paths.

We crack an egg on the side not the end where the dome shape can take a much greater force.

Ref Aust Poultry Vol24/3 p7 Fertile Egg Appraisal.

5. Fresh Air Exchange.

Like any living thing incubating eggs require a continuous supply of oxygen and the removal of carbon dioxide and water by-products of the growing embryo. The gases pass through the porous shell via the blood vessels in the membrane just inside the shell.

At hatching time the eggs generate their own heat and can over heat if there is not enough air exchange to maintain the set temperature. The best information I have been able to find out from testing is that an incubator requires about six complete exchanges of air per hour. When this rate is reduced by too much the hatch rate is also reduced because the necessary gas exchange does not take place.

Six air exchanges per hour has been built into the Smart INCUBATORS, and this gives very good results. The exhaust air comes out of the top of the incubator and can be decreased as desired by changing the number of open holes. The intake holes are in the middle of the sides 100mm from the base also the gap around the door. When building the incubator it has been assumed that the whole incubator capacity could be set at once and the ventilation is built accordingly. If the egg capacity is set over three weeks then the ventilation can be reduced a little to save on the power costs. Reducing the number of exit holes can have
the effect of slightly increasing the humidity and reducing the amount of water used by the incubator.

The room housing the incubator needs to have a greater amount of air exchange than the incubator exchanges. If the incubator room smells stuffy it needs more ventilation. Most sheds and domestic rooms have adequate ventilation.

The warm air exiting from the incubator can be used to warm up the brooder room so long as formaldehyde is not used too often to sanitise the incubator as it might affect the chickens brooding. I only fumigate the incubator at the start of the season before setting eggs if I think there is a disease problem.

If I use oil paints in the brooder room the chicks are stressed, with some even dying from the fumes.

6. Turning The Eggs.

It has been found that if poultry eggs are not turned at all then only \( \approx 30\% \) of the fertile eggs will hatch. It is most important to turn the eggs in the first 3 days of the incubation period. At this stage of development the emerging embryo has no blood vessels and the turning moves the blastoderm into fresh nutrients, leaving the waste products behind. The hatch rate can be increased by up to 5\% by giving the eggs extra turns during this period. I have found that over all there is little difference between turning 24 times a day and 2 or 3 times a day with a couple of extra turns on the first and second day. There is no evidence that it is necessary to cease turning eggs on the last 2 or 3 days, if anything, continuing turning seems to increase the hatch.

There was an incubator operator who turned her emu eggs once a day and still had an 80\% hatch! And another who was at her farm 4 days a week, so set the eggs when she arrived home, turned them for 4 days and left them for the rest of the week. She got a 80\% hatch rate!

There is evidence that a respectable hatch can be achieved when no turning is done during the last 10 days. However for poultry I recommend a minimum of twice a day preferably three times. It doesn't matter if there is a variety in the number of hours between turns. e.g. when you get up, dinner time, and bed time are good times whenever they occur. If you miss a turning or two when you go away for a day it is no big drama; the eggs will still hatch without any discernable reduction of the hatch. All eggs can be rolled, 120\(^\circ\) to 180\(^\circ\) but Emu, duck, goose and turkey must be rolled so that the blood vessels next to the shell are formed completely around the egg to get a good hatch rate. Chook, ostrich, and pheasant can be tilted with the big end or the air sack upward. Duck eggs can be tilted if they are turned a minimum of 5 times a day.

Be very gentle when handling the eggs in the first three days of incubation as jarring the eggs can kill the embryo. The light clunking sound made when tilting the eggs does not seem to affect the eggs hatchability

Always take a good sniff when you open the incubator, and this will allow you to pick up infected or rotten eggs quickly. Ladies have far more sensitive noses than men when it comes to foul smells and are 2 to 3 days quicker at picking up the offending egg. This is the main reason that I believe that attending the incubator every day is essential. These infected eggs can explode and infect several eggs around and below them. Making a smelly gooey sticky bacteria laden mess of the incubator that will take considerable time and effort to clean and sanitise. Such a situation is best avoided. When a foul smell does occur pull the trays out and inspect the eggs carefully. There may be a crack or the egg could be weeping goobie globules and usually the shell is discoloured. Candling will help because infected eggs look abnormal, the air cell does not have a clean edge and the shadow is not normal.
7. Humidity in the incubator.
The reason that humidity is important is that it controls the moisture loss from the egg so that the hatching chick breaks into an air space.

Eggshells are porous to allow oxygen into the egg and carbon dioxide and water out. To provide a big enough air cell so that the chick can hatch, the egg needs to lose between 12% and 23% of its original weight, with the optimum being 15%, to accommodate the chicks head during hatching. This allows it to breathe air and not drown in the egg fluids. The large range of water loss from the eggs allows for a big range of eggshell porosity. If you look at these figures it is better to err on the side of running the incubator drier (11% tolerance) rather than wetter (3% tolerance). This loss of fluid occurs over the whole of the incubation period so there is no problem if the incubator is running with a low humidity some times and a high humidity at other times. So long as the moisture loss averages out over the 21 days of incubation to a point that allows the chick can hatch.

The progression of the egg's moisture loss during incubation can be monitored by candling the egg and comparing it to the diagrams supplied will give a good indication of what the air cell should be to allow the chick to break into an air space when it is hatching.

Have recently been running the incubator dry which is approximately 17% with the only problem being that some chicks are stuck to the shell when hatching. Maybe adding water for hatching is needed? Most certainly there will less power used to run the incubator

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Natural variations from breed to breed and from bird to bird will create a large variety in porosity of eggs. To make adjustments, run the incubator dry if the air cell is small or increase the water surface area if the air cell is too large. If the egg has not dried out enough the chick will drown in the egg fluids at hatching, on the other hand if it is too dry the chick can become stuck to the membrane at hatching. Unless helped out of the egg it will die.

I have had several very successful hatches in incubators that were running dry at the time of hatching. I just missed out on checking the water! We are not all perfect. Getting the humidity right is like riding a push bike through a 10ft wide gate, it’s pretty hard to get it wrong!

Candling and monitoring the air cell development is the best way of telling if the incubator has an effective control of the moisture loss. Keep in mind that the porosity of different eggs can be different and require different humidity to achieve the ideal weight loss. By checking the air cell size at day 10 gives a good idea of how well the eggs are travelling.

Be grateful there is a wide range of moisture loss that caters for chicks to hatch always err on the dryer side so the chicks don’t drown at hatching.
With the very dark shells like emu eggs measuring weight loss is the only way to reliably monitor the eggs' development. It is a tedious way of monitoring the air cell development and is done by weighing before and during incubation. Then calculating the % loss.

Aust Poultry vol 21/3 p25 What is the Air Cell?

To find the air sack end of an emu egg put each end against your eyelid; the cooler end will be the air sack. Eyelids are very sensitive to temperature and in the early days before thermometers that is what they used for temperature measurement. But it does not work well when you are sick and running a temperature!

% Humidity is the number of parts per 100 of the maximum amount of water that air can hold at any particular temperature. This max increases from 5ml/m³ @ 0°C to ≈50ml/m³ @ 37.5°C as the air temperature increases. Due to the incubator taking in air at room temperature and heating the air to 37.5°C there is a need to add water vapour into the air in the incubator to increase the humidity. This means to create 40% humidity the 81 egg model uses about ¾ litre a day and the 162 egg model uses about 1 litre a day when operating in a room of 20°C (68°F). However this will increases as the room temperature gets lower and the air surrounding the incubator holds less water.

To measure the humidity in the incubator. Use the thermometer hole to place a long thermometer that reaches down to the egg tray, then read the temperature of the incubator (dry bulb temp) as given by that thermometer. There may be an error in the reading given by that thermometer. The accuracy of the thermometer is not important in this case as it the difference in temperature is what is being measured. Then place a wet muslin sock (wick) over the bulb of the thermometer, and use a small container of water to dip the wick into and keep it damp. Wait about 20 minutes then read the lower temperature (wet bulb temp) caused by the evaporation of the water from the wick. Read the difference in the two temperatures to work out the % humidity from the chart below. The figures are made up using distilled water, clean muslin and a set speed of ventilation.
on to things like the egg tray and can be used in incubators with windows. Refer to "Handy Contacts" at the end of these notes.

The glass tube is filled with water and the wetted wick is threaded over the bulb of the thermometer. Don’t forget to check the temperature when the thermometer is dry to check its accuracy. The charts show the wet bulb reading in °C & °F.

There exists two standard % humidity charts, one where the air is almost stationary, the other is where the air is moving vigorously past the wet bulb (ventilated). The chart is for a ventilated wet bulb hygrometers as in a fan forced incubator.

However all this technology is only an academic point what is really required is a good sized air cell. The best indicator that the humidity is correct is the size of the air cell for the number of days the egg has been set. See above and the next section on egg candling.

This may vary for your eggs in your incubator in the weather conditions that you are experiencing. During extremely wet weather, the water tray may need to be left dry to allow the air cell to develop in size.

Some people find that they get a better hatch if the humidity is increased in the last 2 days. The added water should not be thought as a lubricant, however it may help the membrane to stay soft and not become leathery.

Because I have had several successful hatches in a dry incubator I do not believe there is a need to increase the humidity during hatching. However use what works for you!

### Humidity Control

An incubator that has had no water added to increase the humidity will have a humidity of 17-20%.

In general the Smart INCUBATORS operate at ≈40% humidity with only the large water tray and ≈55% with both water trays on the floor of the incubator. Good results are normally obtained in the Smart INCUBATORS with the large water tray for chooks and both water trays for ducks.

There is little point having an elegant piece of equipment that keeps a constant humidity when a pool of water will achieve the same results at a fraction of the costs.

When you open the incubator and the water tray has dried up don’t worry, just use the watering can to add water and close it after you have turned the eggs. The water does not need to be super clean or distilled. Any practicals in the water will be left in the water tray.

<table>
<thead>
<tr>
<th>dry bulb</th>
<th>wet bulb temperature</th>
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<tbody>
<tr>
<td>37.6°C</td>
<td>15%</td>
</tr>
<tr>
<td>99.7°F</td>
<td>19.1</td>
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<td></td>
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<td>22.1</td>
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<table>
<thead>
<tr>
<th>dry bulb</th>
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<tbody>
<tr>
<td>37.6°C</td>
<td>45%</td>
</tr>
<tr>
<td>99.7°F</td>
<td>72.2</td>
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<td>27.2</td>
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To reduce the humidity, reduce the water surface area. To do this run the incubator using water only the smaller tray or with both water trays dry. Another way to reduce the water surface is to float small containers or blocks of white polystyrene foam on the water.

If however you wish to increase the humidity further than the two trays, place a sponge in the water tray. Another way is to set the water trays on 19mm x 45mm x 45mm blocks of wood or milk bottle tops. This will allow the heated air to circulate under the water trays and warm the water. The water in the trays is normally cool due to the cooling effect of evaporation. Just blow on wet hands to feel the effect of...
warm air in water. The heating of the water increases the humidity because more heat is applied to the water to make water vapour thereby increasing the humidity. Some people have gone to the trouble of putting a fish tank heater into the water to heat the water. At times people have gone to extraordinary lengths to change the moisture in eggs. For example ostrich eggs have had 5x1½mm holes drilled through the shell into the air space and covered with cotton wool to get the moisture loss to 15% - and the eggs hatched! Whereas duck eggs may have ≈15% increase in hatching rate if they are sprayed with atomised water at each turn during the last week. There is a specific requirement for each type of bird and if something works for you then use it!

Don't be afraid to experiment, but do try one small variation at a time and assess the benefits using it all the time.

The accompanying setting chart in p9 gives the settings for the different types of birds; your birds may be slightly different due to their genetic makeup. In general the ≈40% humidity created by the larger water tray suits most birds in the Smart INCUBATORS, and when both trays have water the humidity is increased to ≈55% which some duck breeders prefer.

**Watch the weather**

Watch out for very long spells of warm wet weather with its accompanying high humidity, the air cells may not develop sufficiently for the chicks to hatch freely and the incubator needs to run without added water.

Similarly with long dry spells of cool dry weather can create too big an air cell and the chicks get stuck to the membrane just inside the shell and cannot get out without help.

**In short the water is to control the drying of the egg nutrients and is in no way a lubricant.**

If the chicks get stuck when hatching it is more than likely because of too low temperature.

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**8. Egg Candling.**

There is a multitude of ways of making a Candler such as a light box with a hole and a reflector globe. If you are using a Candler with a 65w reflector globe take care not to over heat the egg. Or leave it on for long periods of time when not in use it could create a fire hazard.

These days an effective Candler can be made by simply using a small torch that has a LED or Kryptonite globe. Just remove the glass at the end of the torch so there is a close contact with the egg. LED torches require fully charged batteries for full brightness which reduces quickly as the batteries flatten.

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If the chicks get stuck when hatching it is more than likely because of too low temperature.
The MINI MAGLITE comes with kryptonite globes that work well with dark brown eggs.

This LED torch was bought at the local supermarket. It works well with white and blue eggs not so good for dark brown eggs.

LED torches lose their brightness when the batteries have a reduced voltage so the batteries need to be kept fresh. Use LED torches with 150+ lumen.

Candle in a dark room for the best results.

Candle the eggs in the incubator when they are 7 to 10 days into incubation, at this point you can easily distinguish between the clear eggs and the fertile ones that have started to develop. The dark spot of the eye should be visible along with some blood vessels. Look at the air sack size and compare it to the diagram in the humidity section, this will give a good indication if the humidity is correct. A record of the air cell can be made by tracking the shape with a pencil and noting the date. If the eggshell is light you should be able to see the blood vessels radiating out from the embryo. A ring of blood that progress around the egg indicates a dead chick; this ring of death is most likely a infection by a bacteria.

The embryo occupies the centre of the egg and looks dark, the small end is light. A contaminated egg will look unusual and not have a sharp boundary but a fuzzy edge to the air cell, break open any suspect eggs into a white saucer away from the incubator and develop the skill of candling. Clear eggs can be used for baking; or feed them to the animals.

It is worth while to master candling because you can get more use of the valuable incubator space by removing unviable eggs at day ten.

There are special and expensive chandlers available for emu eggs but the results that I have heard so far is that only 10% of their eggs are infertile and it barely warrants the expense.

This shows a clear fresh egg about a week old before incubation.

This is a cracked egg and will NOT hatch.
A clear egg at day 7

A fertile egg at day 10 showing blood vessels.

This is an egg at day 10, Note The continuous dark line across the egg. That is the indication of a bacteria that has killed the embryo. I call it the ring of death.

This is the size of air cell that will allow the chick to hatch freely. Note the sharp edge between the air cell and the chick's space.

The chick is starting to hatch by pushing into the air space.

This egg at 21 days will not hatch. Note that the boundary between the chick and the air space is fuzzy.
If you are out at the chook pens and have doubts about an egg hold I up to the sun to check it for being clear.

9. Hatching The Eggs
The theoretical ideal thing is to use a separate incubator with a viewing window only as a hatcher, and to keep the incubator clean and free of chick down dust and possible disease transfer from the chicks to the eggs. Using a hatcher would reduce the bacteria and pathogen count in an incubator by a factor of about 1000. This would also allow the hatch to complete without disturbing the humid atom-sphere. However we can't all afford such a luxury and with mixed setting times the eggs can hatch in the incubator with little loss because the incubator has been built for a fast recovery of temperature and humidity. Also the fact is that unlike commercial flocks most home grown flocks have a high natural disease resistance. I get excellent results using the one incubator, so much so I could not be bothered transferring the eggs to a second incubator.

I once ran an incubator without cleaning or disinfecting, it took 18 months before I got navel infection in chicks. I then took the other eggs out and cleaned the incubator. Then replaced the eggs and disinfected the eggs and incubator with formalin gas. No more problems occurred.

During hatching open the incubator as little as possible even to the point of missing a turn particularly when hatching game birds. I have found that there is little advantage to increase the humidity or to alter the temperature during hatching, others believe that it is essential that the humidity be increased, and the temperature be decreased. Use what ever works for you.

After hatching the chicks will move towards the light of the window in the door and can be removed from the incubator as soon as they are fluffed up and mobile. Pick out as much of the shell debris and in doing so check for stuck chicks. They should be left in the incubator no more than 24 hours. Give ducklings a drink as soon as possible.

Never allow a freshly hatched chick to stand on a slippery surface, they can dislocate a leg tendon and then become "spayed leg". It can happen anywhere. This cannot be repaired. Some seem to manage it any way I don’t know how I simply euthanize the affected chicks.

Some people believe that to help a chick hatch is only bringing weaklings into the world. One possibility is the hen didn't put enough goodies into the egg in the first place, this not a genetic fault but a feed problem. Another possibility that weather variations have affected things all round or it could also be an incubator problem.

Once an egg has pipped at the top and the chick is stuck because it has made a roundish hole instead of a bead of chips. Remove the cap of the egg and get the head free and leave the chick to do the rest. If bleeding occurs blow into the beak of the chick to increase the CO₂ surrounding the chick. With any luck it will start to breathe and the blood circulating in the shell membrane will stop flowing. If you do more the chick may die because it hasn't absorbed the yolk, and if it hatches with the yolk half out it will die. If you think that the chick needs more help after a few hours then break open the shell along the back of the bird.
Chickens hatching normally.

A sure sign the chick is stuck and needs the shell opened for it.

Chicks just do not come out feet first, this bird needs help

When breaking open a shell be aware that the last thing that a chick does before breaking out of the shell is to absorb the remains of the yolk by its stomach closing over the yolk. This provides the chick with a food supply that is enough to last for two or three days. On the rare occasions that you need to help the chick out of the lower half then break the shell down the back of the chick and leave the chick time to absorb the last of the yolk. If the chick’s stomach has not fully enclosed the yolk it will have little or no chance of surviving.

If there is dried membrane on the chick it can be removed by using warm water in an atomiser, and gently massaging the membrane off. Then return the chick to the incubator to dry, often though when left alone it just dries and falls off. I sometimes hear breeders claim that helping chicks out is only helping weak birds survive, this may be so if the bird has not pipped the egg shell. But when the chick has broken open the shell and can’t get out it could be an incubation problem. So why blame the chick or its' parents?
This chick has tried to break out through the small end. Unless it is helped out it will die.

In general don't be in a hurry to help a chick out of the egg. In particular ducks, they can take 2-3 days to hatch and if fiddled with too much they won't hatch.

If you have an old incubator that could be unreliable in temperature control use it as a hatcher for the last two days of incubation so that the main incubator remains clean!

10. Trouble Shooting Egg Hatching

There should be no reason that you can't hatch at least 80% of the fertile eggs. What you can really expect is that 30% of the eggs are infertile. That leaves 70% good ones, and 80% of those, that is 70% X 80% = 56% i.e. about 7/12 set to hatch. Any more than that is a bonus, sure, I've had 12/12 hatch but I don't panic until it is below 6/12, and at 3/12 my panic is almost out of control.

It is a terrible empty felling of inadequacy when you come across dead chickens. All that you can think is what went wrong?

It is difficult to find a solution when, for every undesired outcome there exists several possible reasons for that has happened. So having sat down and read many papers scanned the internet and reflected on my own experiences. I wrote this chapter it is not what I would call the most helpful answer. I can only point you in the right direction, and if you are lucky a solution will emerge. Look carefully at what has been done, hatching eggs is really a bit of the art of skilled husbandry and keeping an eye on details of how things are going, and making sure that as much as possible is done to within the known limits. It could be of great value to re-read OPERATING THE INCUBATOR sections 1-9.

The first thing to do when things go wrong is to carefully check all the settings of the incubator as well as the collection and storage of eggs.

Have a friend who incubates successfully to have a careful look at your set up, and how you are operating it. They may spot what your problem is with their fresh eyes.

The testing of incubator problems is riddled with many inconsistencies that vary from breed to breed as well as line of a breed to other lines of the same breed. Universities and Ag Departments do little useful research for home and fancy poultry people. Keen observation of what is happening and how it varies from the accepted norm is the only way forward.

For me one great source of information about hatching eggs is from hatching eggs for other people as well as my own eggs and talking to these people about the results. For example a young man bought me 15 eggs to hatch, only 3 chickens came out. I turned out that he feed the hens layer pellets. I told him to buy some breeders pellets, 6 weeks later he bought another 15 eggs to hatch, this time he was astounded when he had 13 chicks to take home. He was amazed at the difference that the breeders ration made! From my flock I know that if I don't add a good vitamin and mineral supplement to the breeders food, then the hatchability of the eggs is reduced to ≈40%. Don’t neglect talking to other breeders about their feed regime,
particularly those that have the same varieties of poultry.
Needless to say I now take great care with my own personal diet and even eat up all my broccoli and carrots! But I draw the line at maize, I don’t want yellow legs.

What else can be done?
Candle or open the eggs and ascertain at what stage did the embryo die? Most deaths are in the first and last days of incubation. The stress of the early days is mainly because the egg is relying on being turned frequently to get nutrients to the embryo. On the last 3 days there is the stress of running out of the required nutrients. All it needs is for one thing to be missing when the egg was made, the chick can’t nick down to the shop to get the missing ingredient. Another problem is the chick moving the breathing system from the membrane just inside the egg shell to using the lungs. I have had a hen that every egg she laid died at about day 18 no doubt a lethal gene was involved.
The incubator can be checked out by getting some fresh cross bred eggs and running them through the incubator, you would be amazed how often these eggs hatch freely!

Here are some ideas for these problems
A1 Early development deaths
A2 Middle days, deaths
A3 Late days deaths
A4 Uneven hatching across the egg tray
A5 Clear eggs
A6 Almost nothing hatches
A7 Sticky chicks covered in egg white
A8 Egg handling problems
A9 Trying to hatch out of the small end
A10 Malformed chicks and crooked toes

A1 Early development deaths can be caused by
- not turning the eggs enough times in the early days.
- incorrect set temperature of the incubator, (more than 0.4°C or 0.8°F out and forget about chicks)
- fumigating in the first and last 5 days of incubating
- genetic problems of the strain of birds
- poor ventilation of the incubator / room
- nutrition of the breeders feed

A2 Middle days, deaths can be caused by
- over/under temperature,
- extended power failure,
- infection, the blood ring of death!
- poor ventilation,
- problem with breeder rations.

A3 Late days deaths can be caused by
- poor breeders rations
- breeders rations again
- incubator set at more than ±0.4°C (0.8°F) from the best temperature.
- infected eggs (usually dirty)
- lethal genes eg ear tufts
- humidity too high/low creating an air cell not in the range that allows hatching.
- problems caused in the previous weeks that stressed the embryo such as temperature fluctuations.
- genetic problems.

A4 Uneven hatching across the egg tray
If the hatch is not even over the tray this can be caused by as little as 0.1°F across the tray. It may be caused
- by the fan blowing unevenly down the different sides
- or the fan bearings getting tired and the fan not blowing hard enough.
Problem solved by rotating the egg tray 180° twice a week
A5 Clear eggs could be from a variety of stocking problems such as

- Male/female infertility, caused by old age, hens simply run out of ova that form into eggs after about 3 years
- Male being left without water or stressed in other ways can cause a low sperm count for up to 6 weeks. Check the water everyday particularly when it’s 30°C+ (86°F+)
- poor nutrition, of breeders.
- lack of suitable stones for their gizzard to grind the food effectively to get the most out of what’s been eaten,
- too few/many males in a pen 1/6 is a good ratio,
- low sperm count in winter(old males do not produce sperm until spring), just not producing enough sperm,
- birds being knocked about by disease,
- not enough pen room to function properly during mating.
- preferential mating by the male having his favourites, and the hen at the top of the peck order not mating
- the male has feet or leg problems and can't mount effectively.
- too much fluff around the vent, -both sexes – pull the feathers out around the vents, cutting them will make for painful copulation.
- too many pen disturbances caused by strange people, dogs, foxes, even adjoining pens with a continuously loud cacophony of excitable birds that just don’t stop. The noisy birds can be settled by playing ABC classic FM or jazz all day. Probably the neighbours would appreciate the noise reduction, I did.
- Poor egg storage – below 4°C

A6 Almost nothing hatches from fertile eggs.

Use a clinical thermometer to check the temperature the incubator is running at

- if those that hatch are early and active and there no late hatching then the temperature is more than 37.6°C (99¾°F) from the desired 37.6°C (99¾°F) decrease the set temperature by at least 0.3°C (½°F)
- if those that hatch are late and there is nothing early then the temperature is more that 0·4°C (-0·8°F) below the desired 37.6°C (99¾°F), increase the temperature by 0.4°C (¾°F)
- poor diet of the adults
- infected eggs
- Very old eggs used, eggs more than 10 days old hatch poorly usually late and produce lethargic chicks.

The fan is running the wrong way it should blow down at the top of the door and suck up from the middle of the incubator. The body of the motor needs to be turned over so that it rotates in the opposite direction.

Eggs stored at more than 20°C or below 4°C

A7 Sticky chicks covered in egg white

again I have no idea except to say that I have had two trays of eggs, one was mine the other was from outside. Set on the same day in the same incubator mine hatched sticky and the others were fine! The next hatch of mine was also OK! To me it could be the something that was in the pen, poor food or a bacteria infection or using old eggs.

Often with a normal hatch the last chicks to come out are sticky and weak. Maybe the eggs set were more than 10 days old, Maybe such stickiness is within the spread that could be called normal or the incubator is running 0.1°C cool .or there is a temperature difference over the tray test with a human shake down medical thermometer. To resolve such a problem rotate the tray twice a week

A8 Egg handling problems, can mean clear or early deaths

- dirty eggs infected before they are picked up,
- rough handling or jarring the eggs,
- stored too long or too hot/cold 4-20°C
- collection not frequent in hot weather,
double yolks and misshapen eggs
- cracked eggs not eliminated,
- egg wash, too hot/cold water, eggs not air dried quickly.

A9 Trying to hatch out of the small end
- Many expert claim that it is caused by setting the eggs the pointy end up but I have seen little evidence of this in hatching some 1000 eggs or so a year. I have no idea why except that, with all animals there is a small proportion of young that try to come into the world in the wrong way. Bit like a breech birth in humans it would be crazy to claim that it was caused by the mother living her pregnancy standing on her head.

A10 Malformed chicks and crooked toes
- more than likely from heredity problems,
- possibly a vitamin B2 deficiency in the hens’ diet usually happens with the early eggs set in winter.
- high temperature i.e. more than 38.5°C (102°F) in the incubator at the wrong time (at about day 8),

To kill a chick humanly because it is malformed or very weak, pinch the neck with a strong thumb and index finger, just below the head after bending the head to one side and dislocate the cervical vertebrae. This severs the blood to the brain after which the chick dies almost instantly. Another a little more messy way is to use scissors or secateurs to cut off the head.

11 Clean The Incubator
To make cleaning easier fit a piece of cardboard on the floor of the incubator to catch the rubbish that misses the water trays. Throw it out at the end of the season.

After each hatch clean out the broken shells, and the end of the season remove all the debris out using a vacuum cleaner, wash the water trays if foul, and clean the egg trays that have been soiled with stickies from the eggs before it sets and becomes difficult to remove. There is a possibility that the stickies will glue the next egg to the rail and a hole is torn when the egg is tilted.

When you have a disease problem wash out the incubator and water tray with hot soapy water (dish washing detergent is fine) or GERNI WASH which is a pH neutral detergent and works well with a high pressure water spray. Allow a few minutes for the soap and water to soak into the grime then it’s a liberal amount of elbow grease and an effective brush to cleaning up the dribbles stickies and bits of egg shell before setting more eggs. Use steel wool and turps for the really hard globules. Fumigate or sanitise the incubator if you think it is needed because of disease problems.

The best brush that I have found for cleaning is made for cleaning dairy machines called a churn brush then made by Alpha laval (now de laval). They have bristles that can stand temperatures up to 121°C (hotter than boiling water). And last almost forever.

The upper brush is new the lower brush is 20 years old and still effective. They are expensive but good and the long handle means that they are easy to use when inside the incubator and on the egg trays.

I only sanitise during the hatching season if I suspect that I have a disease problem with the eggs or the incubator. This is indicated by chicks dying within 10 days out of the incubator.

There are many materials available to sanitise the incubator in all cases the sanitisers will only be effective on clean surfaces. In other words they will not penetrate muck.
To work properly all sanitisers require that they are in contact with the surface for about 30 minutes.

Treat all sanitisers with caution they are poisons. Wear gloves and goggles and use the correct proportions in the mixes, stronger mixes will not necessarily make them more effective but lower rates may encourage pathogens to become resistant to the sanitisers.

N.B. Very small quantities (a teaspoon full) of quaternary ammonium the main ingredient of most household disinfectants (PinoClean) will stop all the bacteria that operate in a septic tank so take care where the waste is disposed.

My first choice of a sanitisers is to use the traditional formaldehyde It is very effective sanitisers in incubators when used properly. (this has lost favour due to beliefs that it is carcinogenic). For many years butchers used it in their cool rooms on Saturday afternoon to sanitise any meat hanging over the weekend.

The fumigation is achieved by putting a ceramic dish like a saucer with ¼ teaspoon of Condi’s crystals (potassium permanganate) in the incubator. Seal the incubator vents with blocks or tape. Then pour about 20ml of Formalin onto the purple crystals. Shut the door and go away from the incubator for half an hour it stinks! When you return make sure the room has plenty of ventilation and open the vents. And go away again for another half an hour. Only use formaldehyde on eggs when they are introduced into the incubator and they are cool or during the days 6 to 16 of incubation of the eggs. Don't fumigate eggs in the first 5 days or the last 5 days of incubation it will possibly kill the embryo.

Alternately use a atomiser to spray with 3% quaternary ammonium (Benzalkonium chloride) an example of this is Canesten by Bayer and PinoClean. Or another mild sanitising household disinfectant that can be used is 'White King', (sodium hypochlorite), alternatively eucalyptus oil is acceptable. Domestos is for cleaning toilet bowls not incubators it very corrosive and will do great damage to any metal in the incubator including the electrical components. Similarly Bactrosan and Vircom B will cause server corrosion of the electrical parts.

Then again, the egg trays can be taken outside, hosed down and scrubbed clean with a brush and hot soapy water, then 15 minutes later hosed again to remove the loosened stickies. A high pressure water spray like a GERNI is very effective when I comes to cleaning the egg trays. After cleaning leave in the sun to let the ultra violet rays to disinfect them. There have been cases where UV lights have been put in incubators as a steriliser.

Do not use a Chlorinated Iodide disinfectants such as Bactasan or Domestos because they are basic and they corrode the electrical and metal components as well as damaging the fan bearings.

When you have finished using the incubator be sure to remove the water in the water trays. Then clean and sanitise the inside and trays. Then run the incubator for about 3 hours to dry it out. Leave the door ajar. This will reduce the likelihood of water condensate rusting the fan bearings. It is so much more pleasurable to start the next season when all the gear to be used is clean.

The outside of the incubator can be cleaned using a cloth dampened with turps. Then spruced up by using Mr Sheen to put on a shine. If you use water take care that the water does not drain into the holes of the top, if it does then allow a few days before turning the unit on again. Or take the top off and dry the components with a hair dryer.
In the second and consequent use of the incubator there may be a burning smell when the incubator is first connected to the power. Much the same as when a radiator heater smell when started. This is OK because it is due to some feather fluff caught in the heating coil, and it should clear in a couple of minutes. Feathers fluff is like wool and will smoulder rather than burn.

At the end of the second season find someone who is electrically competent to clean the works at the top. This is done by first disconnecting the power supply, then remove the 7 slotted brass wood screws on the top of the sides, and lift off the electric section which is the top of the incubator. Next remove the sheet metal baffle by removing the 4 x ¼W nuts, as the baffle is removed disconnect the earth wire.

Clean the dust off the fan, heating coil etc using a vacuum and soft dry paint brush. Use a little turps to dampen a rag or paint brush to clean the hard to remove gunk from the ply panel. Compressed air can be used to gently blow the dust away and from under the circuit board. When reassembling the unit, be sure to reconnect the earth wire to the metal baffle and check that the earth wire is clear of the heating element.

Check by looking side on across the assembled top that there is no contact between the heating coil and the earth wire to the sheetmetal shield/baffle as this can cause an over heating problem by the thermostat being bypassed and the heater being permanently turned on. The same goes for the wires to the internal light fitting.

To clean the windows use Mr Sheen and if needed take the inner Perspex off by undoing the four screws holding the sheet in place.

Having said all that bear in mind that I once ran my incubator for 18 months without any form of cleaning. The plan was to test the natural immune system of chicks and eggs in an incubator. When I started to get naval infection and chickens dying after 10 days in the brooder. I cleaned everything put the eggs back in the incubator and fumigated with formalin. No more deaths. This says a lot about the natural antibodies that exist in eggs and chicks.

**RAISING THE CHICKS.**

**a) Caring For The Chicks**

The chicks come into this world with the last of the yolk in their stomach and have enough food to last 2 or 3 days in the case of poultry chicks, and a week in the case of big birds such as emus. So there is no need to rush to feed them.

The basic requirements of artificial brooding are suitable warmth in a draft free box (a good size is about 600 X 600 X 600 mm), that has a light shining on the water, and the food. If the chicks cannot see the food they will not eat. If they don’t drink, they will not eat dry food. During the cold months the chicks will eat and drink more. Chicks have a limited ability to keep themselves warm, and some form of external heat during the first weeks of life is necessary. A hen can be replaced with an ordinary 42W Halogen Energy Saver globe or 40W fancy round globes made for fancy light fittings. BUNNING’S and WOOLWORTHS sell coloured 25w incandescent globes yellow followed by red are the best colours two of these globes is needed. A 18W energy efficient globe is ok for summer time after 3 weeks, or when the chicks have feathers. Pet shop stockist have 50w ceramic heater globes they need to be 200mm above the litter. Also there is a need for a light source so the chicks can see the food and water. As the chicks will not venture very far from the source of heat in the first week. The heat source must be close to the food for the first week or so, until the chicks have some wing feathers. In the first few days they could die because they have not established an eating and drinking regime. When this occurs all the
chicks die within a time period of 48 hr usually happens about the 5th-7th day after hatching. Putting the smallest chick from a previous hatch in with the new ones will show the younger chicks to eat and drink. Otherwise spread some food on the litter at the edge of the heater, dip the beak of some of the chicks in the water that has red electrical tape wrapped on the outside of the container and the neck of the bottle to attract the chicks.

For the first week during winter, cover the whole of the box with a couple of empty feed bags for a little more warmth. After a week or so move the brooder away from the feed to encourage the chicks to walk. There have been cases where the brooder room has caught fire so a smoke alarm might be a prudent accessory in the room.

After about 5 days there could be a problem of the chicks’ vents being bunged up with manure that does not fall away. This is more prevalent with tiny chicks such as Sebrights and Rosecombs. It doesn’t take long to lift each chick and check, but if left the gummed up chick will die.

Check their bums again in a week’s time as well their feet for manure knobs that can garrote toes and the end of the toe falls off. The manure knobs usually form in crowded conditions where the litter cannot absorb the moisture from the droppings and becomes a hard surface. Giving the litter a stir up every now and again and adding Lucerne chaff will reduce this problem. I add a layer of Lucerne chaff to the litter as part of their food (8% protein) and encouraging scratching.

The temperature at the litter level should be about 30ºC to 33ºC (85ºF to 90ºF) during the first week. A fish tank thermometer with its bulb enclosed in lead shot is very good for making a temperature reading. When a power outage occurs, the chicks will huddle together for communal warmth. For an extended time without a heater, a very good source of heat is tap hot water in PET soft drink bottles laid on the litter and bags over the box.

The energy from the incandescent globes is given out as 98% heat and 2% light, thereby doing two functions at once. The globe holder is mounted in a 7/8” (22mm) hole in the middle of the metal dustbin lid or some thing similar like a cake tin. The heat from globe creates a pool of heated air is held above the chickens. The top of the lid held about 150mm (6”) above the litter by using legs made from 25mm flat steel straps, bent to make feet so that they don’t sink into the litter. (See diagram).

Fancy coloured 25W globes can be bought at supermarkets and hardware stores two globes are required to provide enough heat.

Make the legs 150mm above the litter. At this height the globe is almost 4cm above the litter allowing the chicks to make contact with the globe when they feel cold. Such a unit will service up to about 25 chickens, any more and there is a risk of chicks being killed from overcrowding and suffocating the smaller chicks when they are cold. It really is a Goldilocks job, not so hot that the chicks can't get under the cowl, and not too cool that they crowd around the globe on a cold night. Similarly with emu chicks under pig lamps there seems to be a 20 limit per light before suffocation occurs on cold nights. The globe is held at a height that allows the chick to get very close if it feels cold.

The lid heater or two lid heaters if there are more than 20 chicks is placed in a large card board or plastic box to prevent drafts giving the chicks a chill. Last thing at night and first thing in the morning check that the globe has not died, and while you are there turn the eggs in the incubator. If a heater has failed over night and they can at any
time, the chicks will huddle together for warmth. However if they have been chilled to the point of being lethargic then a spell in the incubator will probably revive them. Using a new globe with new chicks is a good move to prevent losses of very young chicks.

The costs of running many brooders can become substantial and using 40W globes is a lot cheaper than 100W globes. Don’t be tempted to leave an incandescent globe hanging on the side of a cardboard box. It has been known to have caused a fire that burnt down the shed and some of the unfortunate blokes house- no he was not insured!

Always smell the air when entering the brooder room for smouldering from the heaters.

If incandescent globes are unobtainable then 50w or 75w ceramic heating ‘globes that are used for heating snakes can be obtained from pet shops or feed suppliers. These have Edison screw fittings that are normally stocked alongside the heaters. When mounted or hung about 200mm above the litter they will produce a temperature of about 37°C at the litter level, this can be measured using a fish tank thermometer. A low voltage brooder is made by Brinsea called Ecoglow and I believe that it is now available. Ref Aust Poultry Vol 27/5 p27

The litter should be not only absorbent, but be thick enough to provide heat insulation and be free of fine dust. The best is coarse sawdust from timber mill break down saws (not from cabinet making). Timber has remarkable antibacterial qualities. I usually use feed bags to bag up about 20 bags of sawdust in summer stack them in a dry shed so they will be dry and ready for the winter hatch. Other serviceable materials are wood shavings, rice hulls, peatmoss, dry sand, Lucerne or oaten chaff and shredded paper. Almost any material that will absorb moisture will do, except things like cotton waste that can catch up and tangle around the chicks’ legs.

Damp litter will start composting and generate considerable heat as well as ammonia gases. It’s time to change the litter when you can smell ammonia, the fumes will be much stronger at chick level and not the best for them with their only source of air is contaminated. When this occurs the litter may be caked and manure knobs have formed on the chicks toes and the knobs can be removed by squeezing them with electrical pliers.

The top of the box is covered by a wire mesh to discourage cats and snakes from having chicken nuggets, and later to restrain the chicks when they are bigger from jumping out of the box. After about 4 – 5 weeks the heater can be replaced with an 5W energy efficient globe resting on the wire mesh over the chicks. It will provide sufficient light for the chicks to see the food and water. Expect them to eat more food without he heater.

When using a multi outlet power boards be sure to clean dust out of them regularly to avoid a fire hazard. Check the board for heating and replace it if it feels warm because they are a great source to start a fire.

Last thing at night check that the globes in the brooders are going ok and that there no burning smell of a globe heating some combustible material. And during the same visit, while you are there turn the incubating eggs.

See also the attached sheet on ‘HOW TO MAKE A BROODER’, on placing the light close to food and water so the chicks can see the food an water otherwise they starve.

The water dish can be a bit tricky, big enough to hold a day’s water, and yet small enough that the chicks will not drown. To be attractive there must be enough light that it can be easily seen, and if possible red in colour. Chicks go for red things first followed by yellow then green while blue appears black to them. The red colour can be achieved by wrapping red electrical tape around the outside of the tin and the neck of
the bottle. In the first week out of the incubator, the water supply must be close to the heater that keeps them warm.

A cheap waterer can be made from a glass sherry bottle or flagon strapped with hoop iron onto a wooden frame. It would be a smart move to only use one shape of bottle so they can be inter-changed between stands. A fish food can or a small ceramic bowl to hold the water. See the attached sheet HOW TO MAKE A WATER DRINKER FOR CHICKS.

The photo shows how the straps are bent around the back and fixed to hold the straps in place. The 2L bottles hold 3 times the water that a 700ml bottle holds.

The waterer is set up by filling the bottle, put your hand over the top and turn the bottle upside down then remove the hand and drop the bottle into the frame. Very little water falls out as it goes into place. If you are unsure have a practice on the lawn.

A 2litre water bottle lasts about a day for 30 two week old chicks.

When the water bottle is used with quail or partridge chicks fill the water tin with 5-10mm diameter stones so that chicks can walk on the stones and drink from between them. Otherwise they will drown in great numbers in a very short time because they are not very good at walking on water and making all the effort to incubate hatch them a waste of time and effort.

This drinker was made from treated pine 15 years ago. Another version where 2l flagon was used with a 70mm high tin and was made for ducks and older chicks.

The stones that I have found successful are from my fish tank.

For a feeder a similar arrangement can be used by using a 2 or 3 litre PET cordial or juice bottle with a 30mm top. A hole is cut in the base for filling. Then it is strapped firmly to a wooden frame to allow the feed to gravitate into a fish tin that is red. It can be coloured by wrapping red electrical tape around the outside of the tin.
See the how to make it work sheets on HOW TO MAKE A FEEDER, a drinker and a brooder in these instructions.

Use medicated chick crumbles to combat coccidiosis in chicks that has about 18% protein. Turkey crumbles are necessary to prevent black head in turkey, quail, and pheasant poults. In fact all game chicks need a higher protein level in their feed minimum of 22% protein. There is no problems feeding turkey crumbles to chickens, they will eat considerable less food so the extra costs are balanced by the lower consumption. There are feed companies that make special game bird chick crumbles that have a very high protein up around the 24-28% mark for pheasants. To get some, ask your local feed merchant well before the game birds hatch. If a high protein feed is not available then supplement the feed with chopped up hard boiled eggs, chopped up lettuce and high protein dog food.

Be aware that medicated crumbles older than five months have lost their medicinal value. Chick crumbles that have been spread over the litter are not wasted if after cleaning the brooder the litter is thrown out into a chook pen the birds will scratch through it for the goodies.

If the feeder is filled each day you can get a good idea on food consumption, and have a check on whether the feeder has blocked, by a chicken or clumped food, it doesn't happen often but if it does and you don't find it, then all your good incubation work is wasted. If the chicks use the feeder as a perch put a margarine container to cover the top hole to stop their manure contaminating the feed. A blocked feeder can be freed up by using a long screwdriver or a piece of wooden dowel pushed down from the top through the feed.

Place the brooder where you walk pass often, this will help make the chicks quieter and easier to handle.

In the brooder shed have little areas that escaped chicks can be herded to for easy catching. Chicks that escape from the brooder box generally find their way back so there is little value chasing them all over the place. Often they will return to the brooder on their own accord. To catch a chicken that has escaped from a brooder place one hand in front of the chick to distract it while the second hand is brought up from behind to capture the bird. If they are difficult to catch then maybe the Darwin effect is happening. I now have a collie dog that makes it her business to locate escapees.

After a about 6 weeks or so to help get their gizzards going properly throw a hand full of stone dust or small stones on to the litter for the chicks to scratch and pick through.

I have been told that hard boiled eggs feed to chicks 2-8 w seems to stop feather picking.

When the chicks are feathered, usually after 5-6 weeks they are ready to be moved outside. As the weather warms up the chicks can be moved out outside earlier. To hardening the chicks off the heater can be removed and a low wattage (5-15W) energy efficient globe placed on top of the mesh protecting the chicks to illuminate the food and water after a week or so move them to a outside pen. I try to pick a sunny day for the move.

Keep the groups less than 20-30 birds a pen to reduce losses if the chicks get cold and pack themselves on top of each other. There seems to be a limit of 20-30 where chicks that can recognise each other, any more than that and they are constantly re-establishing the pecking order.

A low perch that is 75mm wide placed on a couple of bricks radiating out of the corners will reduce most of the loses from over crowding pressure at night. I also place foam boxes on the side against the tin walls for insulation. The foam is eaten as they grow and eliminates vent picking.
A brick in the water bowl allows for an even chance for any chick that ends up in the water to survive.

After moving the chicks to the outside pen, it is a good idea to check on them after dusk to make sure that they are not piled on top of each other in a corner. It may be a case of resecuring the bottom birds from suffocating. The chicks may have settled against the pens mesh where they can get wet from rain, or exposed to frosts.

I use the less expensive adult feed but because the birds are growing rapidly they will consume about the same as an adult bird. If you have coccidiosis problems, when you move the chicks outside make sure the litter is dry and keep feeding the medicated feed for at least another 14 days to combat any new varieties of coccidiosis that the birds will come in contact with at the new site. The vitamin feed additive that can make the difference from 40% to 80% in the number of fertile eggs, must make a positive difference to the growth and development of young birds.

As the birds are moved outside the sexes can be separated and the culls sorted to the cull pen, later when the birds are approaching maturity more culls are sorted. Mixing birds from the brooder into an established pen will lead them to being bullied by the established birds. If you use electrical ties for quick identification be sure to clip off the end so the birds do not pull on the end and tighten the tie on the leg and garrote its leg. And keep an eye out on them as they grow that the tie doesn’t get too tight.

b) Vent and Tail Picking
This can be a problem with 6+week old chicks, in crowded conditions. The damage caused can leave birds that don’t grow a full tail or to many deaths of otherwise good birds. The natural world of chooks is they have been made to peck and scratch. They use their beak much like people use fingers but at times the pecking gets out of hand. In a pen the victims cannot run away from being pursued by dominating birds and usually retreat head first into a corner where their tail and vent are repeatedly pecked.

If you tap the shiny red top of a pen on the ground in front of a chick you will see the natural response for the chick to start pecking. Birds see at the red end of the spectrum as bright and attractive while the blue colours appear as black or no colour. This is not normally a problem but if there is blood around for any reason the chicks will become excited to peck at the shiny red blood. When this occurs in the brooder it can be stopped by using or painting the globe red. All things will appear red and confuse the chicks. Some breeds are more susceptible to vent picking than others.

There are some strategies that can help.

With older birds it appears that they can recognise up to about 20 other individuals, more than that number they are constantly establishing their pecking order. This is an aggressive atmosphere that leads to bulling, and often the weaker birds are seen cowering head first into a corner having been pecked by all the other birds in the pen. The more birds there are in the pen the more they are pecked. If the attacking occurs when the tail feathers are emerging and full of blood, then the red appears and the other birds can’t stop themselves pecking away until the unfortunate victim is disembowelled and dies. By having a quick look each morning and evening, the early signs of red rumps or cowering can be easily seen. Also when they are feeding off the ground the rumps go up and any victim can be readily detected. After the skin damage has healed to a dark colour and the feathers have grown it can be reintroduced to the pen. Pens of about 12 birds seems to work well.

I have had two separate lots of leghorn chickens start vent picking in the same pen that has a high intensity of light. Strait away I sorted out the culls and moved the keepers into a pen with subdued light for immediate success with no more picking.
Commercial growers remove the end of the birds beak to prevent pecking, it seems cruel to me as an important part of a chooks life is pecking along with scratching. They use their beaks like we use our fingers to explore the world we live in.

An old hand claimed that the white foam boxes and / or packing occupies the chicks pecking instinct and so vent pecking is not pursued by the chicks. I use this idea and as long as there was white polystyrene in the pen there has been no vent pecking!! But as soon as they run out of foam the vent pecking starts. The foam is more attractive when it is hung from the roof. There has been no evidence that the polystyrene affects the birds in any way. They see it to enjoy the pecking activity, the sound and the texture that pecking the polystyrene foam makes. When pecked it seems to satisfy some urge. It is usually done as a communal activity similar to vent pecking and some of the foam is eaten as well as most being flicked about the pen. It has no observed detrimental effect on the birds, or the compost in the garden.

Another distraction can be created by dangling a whole cabbage from the roof at a height just above the chooks heads. They don’t last long about 3 or 4 days but chooks really enjoy the entertainment. Feeding out bread is another distraction that seems to work.

Another successful method when vent pecking started in a pen was Stockholm Tar. Vaseline, and red poster paint for colour, mixed together and buttered the tails of every bird in the pen. The vent pecking stopped! I have repeated this several times with good results.

A very effective deterrent is PICK-NO-MORE COVER UP LOTION available from www.strombergchickens.com it cost about $US12 plus freight. It is like ‘PECKS’ a little dab goes such a long way. When applied to the tail of a pecked bird only once it is enough to stop the attacks, so a bottle last a long time.

It worked when I used it on a bloodied tail cockerel with only one application. Mind you the parsons nose was so damaged that when he got older there was a drooping tail and not a lot of tail feathers leaving the bird only fit for the pot. So speed in recognising that a bird is being attacked is paramount. The PICK-NO-MORE COVER UP LOTION did not work with a determined mature cock asserting his dominance, removing the victim was the only solution. In general young cockerels can be kept together until they start to crow, then about three is the most that can be penned together without serious fighting.

In a small book called 'Crested Bantams' by Lyn G Brenneman, there is a formula for a magic cure by Ralph E Harlow. It goes like this, to 50g of warmed VASELINE; add 5ml of Carbolic Acid (PHENOL), and enough MERCURIO-CHROME for a red colour. Mix thoroughly and butter liberally on affected birds. The offenders will soon give up pecking red areas as soon as they get a mouth full of the foul tasting mixture. I have not lost a chick from this mixture, and it works! Only one problem, Mercurochrome and carbolic acid are almost impossible to obtain these days.

Putting a mature cock with young birds seems to help keep order in a pen of young ones and settle down squabbles amongst the youngsters and greatly reduces vent picking.

Another observation is that there are no discarded feathers on the litter of pens of young birds, they appear to have been eaten. Is eating feathers part of the chicks growing up? Some years are worst than others. Some breeds are more susceptible than others.

The best solution I have found is the white foam boxes. The birds seem to like the sound that is made when they peck the foam. The polystyrene foam does not affect the birds in any way.

Don’t put a young bird in with developed birds without watching very carefully to
whether the older birds accept the new addition. If it is not accepted it could be dead the next day.

c) Vaccination of chicks
There is two ways of approaching poultry health.
1) Vaccinate like crazy.
2) to be lazy and let natural selection take place as per the Darwin effect and create immune line of birds.

If you wish to vaccinate against Mareks disease it must be done in the first 2 or 3 days. If buying the vaccine from the local vet make sure that they know to keep the virus vial in the freezer or it will be useless. The vaccine is now only available in 1000 dose lots that must be used within 2 hours of mixing. It cannot be stored after mixing nor can the pack be broken into parts. Never disinfect or use detergents on the skin that is to be injected because the vaccine will be killed. Discard all syringes, needles and left over vaccine. It is hardly economical unless you are hatching big numbers of chicks at a time. Or you have the golden bird that is worth a very large bucket of money.

An alternative is to keep turkeys and put some fresh turkey droppings in with the newly hatched chicks to infect them with turkey herpes virus this is what is used to give chickens protection from Mareks.

Another solution is taken over about 3 to 5 years and you can produce a Mareks resistant strain by only breeding from the survivors, this can also be done with most poultry diseases. However the first year is the worst, it could be a loss of 80% of what has been hatched, the next year is usually much better with a loss of 50%. The third year it is down to 20%. After that it becomes almost negligible, and you don't have to vaccinate again. That is until a new strain appears, even then the loses will be small and the vaccines may not be for the new strain and not work anyway. Some breeds are more resistant to Mareks than others.

Be careful you could easily end up producing too many chicks in your endeavours to cover the losses.

Just as there are people who are descendants of the survivors of the Black Death in the 16th century have immunity to the HIV AIDS virus because of their genetic makeup, the birds that are breed from such a programme are genetically strong when it comes to resisting diseases. I have applied the same principle to any disease that affects my poultry. So I have one thing less to worry about when raising birds there very few sick birds in the flock. No I don't isolate my breeding stock from visitors and I have many. Have you ever seen a Judge wash their hands between handling birds at a show? Nor do I isolate bird that return from a show! One could call it the Darwin effect and to me it is the most important thing to select when selecting breeders. with a strong constitution that have disease resistant qualities. Otherwise all that will exist is a line of birds that have no health stamina and they require continuous mollycoddling.

Coccidiosis is a major problem with poultry pigs and hand reared calves. The last count that I heard is there are 8 major strains and a least 2 are lethal to birds that have not develop an immunity to them. Since the dairy farmers have not been allowed to use antibiotics on calves a whole new range of coccidiostats have become available from the vets, they appear to be effective. I have told that Stalosan F is an effective coccidiostat available from feed stockists’ at about $65 for 15kg

Here again resistance can be bred into a flock. All you need is the constitution to euthanize very sick birds. What can you expect is all natural reproduction will replace a pair with another pair over their lifetime. A hen lays many eggs and left to go chucky will raise about 20 chicks a year for three or four years. It can be expected that many are killed or die otherwise chooks would over run the world.
Some of the live vaccines interact to develop into a new lethal bacteria so if you inject do one type at a time.

If you come across a listless fluffed up bird. Check its vent for blood from picking or loose excreta from worms or coccidiosis or bacteria. Check its breast muscles if there is server wasting and the breast bone is prominent it is probably Mareks disease and the best thing to do is to euthanize the bird. The best way to kill a bird is to dislocate it’s neck. (see the DVD How to Dress a Chook) But take care a young bird with weak legs may just have too much body weight for its legs to lift, given a few weeks it will become just another gangly ‘teenager’ going through growing pains.

It’s a terrible empty feeling of inadequacy coming across a dead bird, what have I done wrong? Just remember if you have live stock you will also have dead stock, and you can’t win all the time!

Many old timers recommend only setting eggs from 2nd + year birds without saying why! It is obvious, these birds have survived many diseases and produce survivors.

d) Selecting the next generation

Some time along the way when breeding chooks the next generation has to be selected’
Apart from good nature easy to handle birds that are good consistent layers, have a strong constitution, a beauty parade also is important and the best selected. The following is a good example of selecting for one type of chooks that can be adapted to any breed.

CULLING LEGHORNS
by Frank Morden. From the VFPA JOURNAL February 1992

A typical culling program may be as follows:

At day old.
Before toe punching and moving chicks from the incubator (or from the nest if hatched naturally), cull any chickens with twisted beak, thickened hocks, splayed legs, bent shanks on toes, webbing between toes and any sign of feathers on legs or feet.

At 6-8 weeks old
Examine each chick carefully prior to moving them out of the brooder or away from the mother. Start systematically at the beak, which should be straight and closing neatly, then work down. Count comb serrations on all chicks and cull all birds with more than five. Cockerel’s combs are quite prominent now so check for clean riser at the front, creases above the beak especially if only on one side will surely eventuate in a comb that falls over. The blade should finish neatly, not "fly away" or have a "fish-tail" which is most objectionable. Serrations should be neat and well tapered from a broad base not penciled or uneven.

Check the face is clean with no heavy eye brows. Ensure the breastbone is straight. With the bird held in one hand run your other hand along the birds back and discard any with faults including raised spine, a hump or lump in the middle and hips not even. The back should feel flat from the shoulders to the base of the tail.

Stand each bird on a hessian bag or other non slip surface and check for leg and foot faults as above. Any bird which quite obviously fails on type should also be removed at this time.

Expect to cull at least 40% (10-12) cockerels and 10% (2-3) pullets at this stage.

At 14-16 weeks old
Chicks now have their first lot of adult plumage, they will be perching if allowed, and "type" is becoming evident. Check head points again as above, but look also for coarse thick combs, wattles uneven in length, and twisted, pecked or weak thin lobes in cockerels. Don't worry about eye
colour which may still be pale orange at this stage. Examine breast bone, back, legs and feet again, looking also for coarse scales, flat shanks, twisted toes etc. Check plumage especially wings and tail for narrow or twisted feathers or webbing faults in wing flights and tail coverts. Some colour faults may also now be evident. Watch the birds as they walk around their pen looking for those which fail in type, such as high tail, short thighs or shanks, narrow shoulders, short backs, in-kneed or incorrect balance and style. Any doubtful birds should be examined in a show coop and then dealt with accordingly.

Don't be too concerned about low tail carriage at this stage as this may be a characteristic of birds which are shy and well down the pecking order.

You should have reduced your cockerels by a further 25-30% (6-8) and pullets by 10% (2-3) at this stage.

Your most promising males should now be penned separately to avoid the disappointment of being spoiled by fighting.

At 20-24 weeks.
You should now have about 25 birds left (20 pullets and five cockerels). They are reaching maturity and changing almost by the day.

Discard any birds with obvious faults as they become apparent such as colour faults, badly serrated or beefy combs, bad lay of comb, weak or twisted lobes, and light eyes, (must be fiery red, with a clear distinct iris), light legs, narrow shoulders, short backline or saddle cushion, high or whipped tail carriage. (Remember that the leghorn females tail should be held close showing about three feathers, and carried quite low at about 35 degrees to the line of the back which is only 25-30 degrees above the horizontal.)

You should now be spending time with your fowls looking for the best ones to prepare for the early shows. What a pleasure it is to sit and watch them as they walk around their pen or outside run, because, at the end of a successful culling program all you should have left are good ones. Sit amongst them and feed them some mixed bird seed or other favorite food, handle them gently and as often as possible to quieting them and give them confidence.

Place them regularly in a show pen and compare them point by point with the standard.
To me this is the real joy of keeping poultry.

Along with Frank’s observations do not neglect that the wings of leghorns are held high (a recessive gene).

LOOKING AFTER THE CHOOKS

a) Every day Around The Pens

Visit the pens every day and check for the following until it becomes automatic:-

Look at the water supply for the birds. Birds rely on evaporation of water when they breathe to cool in the heat of summer consequently chooks will succumb to heat exhaustion without available water. So on hot days (above 30°C) alarm bells should ring to check the water supply for every bird. Also chooks cannot digest dry food without water. They will die when left without water for a few days. If the birds seem to be drinking an awful lot of water maybe the bowl has a hole, check the ground under the water bowl.

Look at the corners of pens for harassed birds and for red vents from feather picking. Remember that the weakest bird is pecked by every other bird in the pen.

Look for eggs on the litter you may need to scratch around in the corners.

Look for holes that will be inviting to foxes.

Look and smell for traces of mice and rats.
When finished wash your hands and dry with a towel. Even though there are no known chook diseases in Australia that can be transmitted to humans don’t take chances you never know what can arrive by migratory birds or travellers via airplane.

At dusk think “did I lock up the chooks?”. In stressful times it may be better to leave the birds locked up and not take the risk of forgetting and thereby feeding a fox.

A useful to extremely useful pieces of equipment to have around the chook yard is several large table spoons each attached with stainless steel screws onto a piece of treaded pine 25mm x 25mm that is 1m to 1.2m long. It can be used to pick up eggs in the hard to reach corners particularly as you get older and the body starts to fail. Also it is handy to dig for buried eggs in the litter. Scrape muck off eggs. Rectify the rebel rooster that remonstrate, they are likely to attack and be able to pickup eggs in such circumstances without putting your face in danger.

Even better than a table spoon is a extra large Chinese scoop, they are strong and tough but need the handle extended with a piece of old broom handle. A scoop can hold more eggs, help to catch birds, dig better for eggs, dong agro roosters better. chop apples and similar fruit into pieces. Not only that I use my one to measure out feed. To top it off they cost very little more than a table spoon. They are a traditional cooking scoop used throughout Asia and for a good reason, because the scoop is just a good all-round tool.

To handle dry feed a very handy scoop can be made from a 4litre Heinz tomato sauce plastic jug. The bottom is cut off square about 25mm deep to make a red feed disk, a cut is made on an angle from just below the handle to the lower opposite edge. I have made the cut so that the scop can be rotated in a 20litre bucket when full. They last for about 10 years. The Hinz jug has the best handle that is comfortable to use as a scoop.

Start off with a Hinz 2l sauce jug, use a marking pen and a block to draw a line about 20mm from the base.
With mums good shears cut the base off. Then trim the top back.

Here we have a scoop and a dish for the chicken brooder, the chicks just love red bowl and a scrap for the recycle bin.

b) Catching Birds

It is better to catch birds with as little chasing as possible and not upset them so that they are easy to catch in the future. If possible just stand in the pen for a few minutes to allow the birds to settle and accept your presence.

The easiest place to catch a bird is on a perch where they feel safer. To catch a bird that is on a perch by hand, move one hand slowly to the front of the bird distracts it while catching by the leg with the other. Some birds face away from you and are easy to hook a finger around a leg and you have them!

A bird will feel caught and not move if it is held so it can’t move. Do this by holding its two wings, or its two legs, or a wing and a leg or by one thigh.

A catching hook is essential when catching large birds in a big pen. The leg is hooked by having the bird facing away from you and snaring the leg by quickly pulling the bird towards you along the ground and then grabbing the bird by the thigh near the hook. Be sure to catch the bird by the leg and not the thigh which can bruise the bird and make it harder to catch in the future. If they squawk put their head under your arm as quick as possible to calm the other birds in the pen. Staring at a bird can unnerve them to the point that they will easily panic and become hard to catch in the future. Look at the bird you want to catch with your side vision and handle your catch gently so they are not terrified by the ordeal. It is important to hook the lower part of the leg, if you miss and get the thigh you will most likely bruise the leg.

Don’t make the hook too long, about 800-to 1100mm otherwise you can’t grab the bird that you’ve caught. The loop at the end is made in a variety of sizes, large ones for large cocks with fat legs and small ones for pullets.

For bantams and smaller immature birds a fish landing net is the go. The net is swept along behind the bird and dropped over their head and the ring of the net held against the ground. The bird will move to the end of the net then it can be lifted and held in the net by twisting the neck of the net around to enclose the bird for handling. The bird can then be grabbed by the thigh or thigh and a wing.
Catching nets the wire is 10 gauge soft fencing wire that has a handle made from a loop of the wire.

To calm a bird that has been caught stroke its back with a flat hand or under the chin on its wattles or put its head under your arm.

If there is a very large number of birds to catch out of a pen do it at night wearing a head torch. So long as the birds are handled gently and they don’t squawk catching the birds is like picking up fruit. No wonder a fox can clean out all the birds in a pen on a moon lit night.

Night time is a very good time to move a extra cock into a pen of cocks, the existing group of cocks will accept the new comer if they wake up and he is already in the pen. Maybe they can’t count!

Birds that escape from a pen are easiest to catch immediately they are out before they become orientated in their new surroundings and move quicker when trying to evade capture. I come back after dark and they are usually sitting outside the pen. Or Mollie the collie rounds them up.

c) Having Dogs Around The Chooks

Whatever the type of dog you have, they will be useless without training, which is a wise investment of time and effort. The first thing to do is to train it not to bite and to leave the chooks alone, it will take some perseverance particularly with young dogs. It took several bouts of loud talking and stars to train Mollie the collie to round up quietly and not to jump on the poor victim. Now she is an asset whenever a chook escapes, outside or in the brooder room.

I had a German shorthair pointer which I could lock in a pen of birds to allow her to dig for rats and mice. But so many people that come to my place complain that their shorthair pointer hunting instinct leads then to kill whole pens of chooks whenever the opportunity occurs! The difference is that I trained the dog to respect the chooks and not chase them. She was a rescue dog from the RSPCA with many problems, however I achieved this by only allowing the dog near the chooks while on a lead with me for about six months. She was with me in and out pens to collect eggs until she started to engage with me as the boss. Any form of violence was out, she would cringe if I picked up a broom or hose, a cross word was enough to make her to get the message. Eventually she recognised that because the chooks where my charges they were to be left alone. The other thing that short hair pointers have is an insatiable desire to dig. This combined with her instincts to hunt and kill being channelled together to hunt for rats and mice by digging in the pen litter. It all started when I was sorting pens and after emptying a pen it is dug over to remove excess litter and kill mice and rats. They became fair game for the dog. This created the perfect way to satisfy her drives to dig and hunt. Her natural hunting skills taught me to freeze whenever the birds threw a hairy fit for whatever reason. Usually this happened when she dived onto a mouse the sudden movement and sound would send the chooks into a frenzy. She would then freeze and wait until the birds settled before moving on to the task in hand. She taught me, and I now follow the same procedure when I startle chooks, I stand completely still until the last of the group of birds has stopped moving and look me in the eye and decide that it is ok to walk on. I then creep about the birds like the old man I am or as if I have a server hangover and now, the birds are considerably easier to handle and catch. The results are calmer birds and a calmer chook keeper.
Alla going to great depths to get a rodent kill she digs a pen or two a day.

I once had a Border Collie, she was a whiz at rounding up chooks (Sheep as well) and finding any escapee that was hiding. Mollie the collie has the same skills.

Each dog has its own skills to be exploited. Don’t think that its cruel to keep a dog on a chain and lead, it is a better alternative than euthanisa because the is out of control.

I know of a poultry keeper who trained her dog not to eat any mouse that it killed by always having treats in her pocket to give out for any mouse presented. She did this in case the mouse had been poisoned. My experience is that the poisoned rodents taste terrible to the dog.

I have been told that Maremma dogs are excellent at guarding chooks and ducks from foxes, but must be trained and treated the right way. Also they may bark a good deal which can be a problem in suburbia. They are a working dog not a pet. There is a group of people called Maremma Rescue Victoria that take on abandoned maremma dogs retrain them for new homes.

Peter Fitzgerald trains and sells young Maremma dogs for about $1000, he can be contacted on Ph 0428112295 or 03 9016 4295.

Some research into the characteristics of a potential dog acquisition can save a good deal of heart ache later on. According to the experts the best period in a dog’s life to train them is from eight to fourteen weeks old, this seems so with my new border collie pup. Having said that, Alla was about eighteen months old when I trained her. She has since died of old age after overcoming all her hang ups and trusting all the family. I miss her greatly, both as a ratter and a companion who would always just appear whenever I thought ‘where is that dog?’.
HOW TO OPEN A BAG OF FEED

There are two types of sewing machines that are used to sew up feed bags. They both use a chain stitch that will undo like a zip when approached from the right hand end and the last stitch is unlocked.

1. look at the straight stitch side, with the tail of stitches on the right, (at the end of the line). This is the end to unlock.

2. & 3. The end of the thread is pulled out of the last loop.

4. The released end of the thread is then gently pulled to undo the chain of stitches.

5. The bag is unzipped" and opens as the thread unravels the chain of stitches.

6. If the tail has been pulled too tight to unpick then cut the tail off at the edge of the bag and use the knife tip or strong finger nails to release the first loop. Next gently pull the end of the thread to unravel the chain of stitches to “unzip” the bag.

7. When there are two threads, this also starts at the tail of thread at the right hand end. Only one problem, this time you have a 50% chance of releasing the starting thread. So it might take two or three goes to get it right. The bag is opened in a similar way, but this time it is unzipped” by pulling on one thread at the front of the bag and the other thread at the back to open the bag.

And again if the thread has been pulled too tight to unpick the tail, cut it off at the edge of the bag and unpick two loops in this case. Then pull both the threads one in front and one behind the bag to “unzip” and open the bag.

8. With all the thread that you acquire make a giant ball of string, or a make a kite but don’t leave it around for the chooks to tangle their feet in and slowly amputate their toes or feet.
HOW TO MAKE A WATER DRINKER FOR CHICKS

1. The materials needed are:-
a) 2 pieces of treated pine 90mm wide cut 250mm & 180mm.
b) 2 x 75mm screws or nails to fix the two pieces together.
c) small cat food can (fish food)
d) 2 x 350mm hoop iron straps with screws or clouts to fix them.
e) scrap of wood 90mm long.
f) an empty bottle, the one used was from a very good port I like the ridge on the base and the sharp shoulder to rest on the support. A 2Litre flagon could be used instead.

2. The scrap of wood is transformed into a support by fixing it to the upright so that the lip of the bottle will be about 3mm into the can.

3. A loose loop is made with one of the hoop iron straps about half way up the bottle. Adjust the strap so that the bottle can be moved freely through the strap. The ends of the strap are bent around the upright and fixed on the sides and the back.

4. The second strap of hoop iron is used to form the other side of the bottle support. Again it is set loose so that the bottle can be moved in and out freely.

5. To use the drinker stand it in a corner of the brooder box. Fill the bottle with water, put a finger over the mouth of the bottle, and turn it up side down close to the cradle then drop it into the cradle. There will be almost no spillage.
HOW TO MAKE A FEEDER

1. The materials that are used are mostly scraps from around almost any building site and the home. And they are:
   a) 2 pieces of 90mm wide treated pine, about 350mm and 200mm long (off cuts) and 2 x 75mm screws to hold them together.
   b) A couple of pieces of hoop iron 450mm long. Clouts or 19+mm screws for fixing.
   c) A cat food fish tin (from the mother-in-law), or a margarine container for larger birds.
   d) A fruit juice bottle that is made from PET plastic (does not break down quickly) and must have a 30+mm diameter neck.
   The size of the opening is important to allow the chick crumbles to flow freely out of the bottle into the tin. If it jams up, then the food stops flowing. This will leave the chicks with out food. So top up the feeder each day to check that the feed is flowing correctly.

2. Screw the wood together. Drill a 10mm hole in the base of the bottle, then use a jigsaw to cut a large hole so that the chick crumbles can be poured into the bottle while it is in place.

3. Fix the hoop iron to the upright leaving tabs to bend around to the back. The straps are set so that the bottle is held firmly, and requires some effort to move it up and down. This allows adjustment and the ability to use various containers for the feed to fall into.

4. The hoop iron is bent around the upright and fixed with screws or clouts. It is ready to use. Screws can be used to hold the tin in place.

5. A margarine container can be used if required for larger birds, and ducks.
HOW TO MAKE AND USE A BROODER FOR UP TO 25 CHICKS

1. A cake tin, or a metal dust bin lid, almost any metal container that has a sides to hold a well of heated air can be made into a heat source for chickens. When they come out of the incubator they need to have a heat source of about 32°C. This can be done by a 40w globe(90% heat 10% light) set low enough for the chick to contact it when cold, and move away when hot. In winter I throw a feed bag over the mesh covering unit for the first week to retain more heat.

2. The legs have a flat surface to rest on top of the litter, and set the top of the tin 125mm (5”) above the litter. This will set the globe low enough for the chicks to contact. The hole for the light is made with a 22mm hole cutter.

3. This low sided unit I would use for bantams for about 10 days, then move them under a dustbin lid shown below.

4. The large black plastic box with 400mm sides was purchased from a hardware store, but suitable boxes can be made from chip board panel or large heavy cardboard boxes.

5. My first preference for litter is a course sawdust from the sawmill that cut logs for timber. I collect it during summer in feed bags and dry it by stacking the bags in a dry shed for several months. Almost any absorbent material will work. Rice hulls, Wood shavings, Lucene chaff, news paper, but definitely not waste rag it entangles the chicks legs. The picture shows the heater close to the water and feed. Use this setup when the chicks are very young, scattering food on the litter near the feeder. The chicks can starve or die from thirst if they don’t find the food and water. If its too cold to move away from the heater they will not look to find them. Always use a new globe with each new batch of chicks.

6. After about 10 days the heater is moved away from the feed and water to encourage them walking. At this time I take the feed bag away in winter, even earlier in summer.

7. When the birds have feathered the heater is taken away, and a week later they are moved out.
HOW TO REMOVE MANURE KNOBS FROM CHOOKS FEET

1. Birds with long nails sometimes accumulate a hard round manure ball on their toes, if they are pulled off there is the possibility of removing the whole outer layer of the toe nail. Leaving a very tender inner nail exposed.

2. I once read that the best way to remove the balls was to brick them, but take care not to catch your fingers. Place the offending ball on one brick and gently tap the ball with another brick until the offending ball has been cracked.

3. Progress with care and remove the loosened bits between hits. It may take 3 or 4 goes to remove a complete ball without damaging the birds foot or causing pain.

4. Don’t rush work on one toe at a time

5. Work from one side of the foot to the other.

6. When finished clip any long nails taking care not to cut the pink quick.

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HOW TO SMOKE A CHOOK

Come summer in our house it is not what we are having for dinner, but which way is the chicken cooked! Well this year a new dimension has been added to the cuisine of the familiar poultry dishes. **Smoked chicken.** But not the half baked disasters from the family BBQ, but from the COOLABAH smoker that ALDI store sold for $200. The unit had to be assembled and connected to bottled gas, this was easy to achieve as the unit was well designed and manufactured. Being a bit of a gungho make-believe chef, some old cocks were then dutifully dispatched along with wood chips from the old apple tree branch into the smoker. The result was over dry under cooked flesh that tasted delicious if not very palatable and chewy. Well "the wife" dug up a very old cookbook that had a recipe that worked- bless her heart and sole.

It went like this,
1) Use young cockerels that have not begun to crow (the unit holds 6 large or 9 small birds)
2) Soak the dressed birds in brine. Do this in a 20 litre bucket by placing 500g of table salt in the bucket and add about 10 litres of water. Put the birds in the bucket add extra water to fill the bucket. Put the lid on and leave over night.
3) Next morning fill the small wood box of the smoker with apple wood chips or any other hard wood chips (soft woods are a big no no). With green chips use them as they come off the branch, dry chips will need added water to make them moist. Fill the water bowl with water, put the birds on the shelves, light the burner and set the flame to the lowest temperature (about 100 C). Shut the door and set the vent to the most closed position.
4) After about an hour when the smoke is no longer visible turn the gas burner to the highest level and leave for about 2 hours. Test if the birds are cooked using a meat thermometer in the breast or leg - 185°F or 85°C is the temperature to aim for. A little more cooking may be required.
5) Now you should have some very delicious poultry to eat. Too good for children. The excess can be frozen and the bones and the crispy wings make a good stock for a mock ham and vegetable soup. The costs after processing 100 birds works out to be about $3 per bird including gas and the cooker.
j) Building A Chook House

When I went to build my first one I had a lot of leftover materials that were not the sizes that was in any prepared drawings. So I winged it with what I had with little guidance as to what worked best with the recycled materials that came to hand. Then as usual chooks survived and the kids collected the eggs.

Here are some of the criteria that I think are important:-

Be aware that once a pen has been built there is an inbuilt reluctance in humans to rebuild unless you have oodles of spare time, the pen is falling apart or it is grossly unworkable.

Find out about the local laws on chook sheds it could save a lot of heartache if a dispute occurs with a neighbour.

Pens need to be made to protect the birds from predators as well as containing the birds.

Try to incorporate things into the pen that can be operated with one hand while you hold something in the other hand.

Face the shed to the north so as to allow the winter sun to spread to cover the floor to warm the shed and allow the birds to make vitamin D by sun baking and preening their feathers to harvest the vitamin. A second best choice is to face the pens to the east for the morning sun.

University test have shown that using deciduous trees to shade pens in the summer also reduces the smell of chooks! I don’t know about that but as my wife says that I don’t smell very well at all. But the trees do certainly provide a cooling shade from the summer heat and allow the winter sun through. The trees will take about 8 years to grow tall enough to provide useful shade.

Make the pen tall enough to be able to stand inside without hitting your head on the roof beams after making allowance for the inevitable build up of floor litter (about 8foot. Or 2.4m)

Chicks like to look up at who or what is approaching them and I don’t like banging my head on rafters.

Thirty years ago I built some 1200mm high pens the only use I have for them now is to house single birds like broody hens or reserve or store cocks. When you get old it is no fun crawling around catching birds, retrieving eggs or cleaning out the floor litter from low pens. Besides, in tall pens chooks seem to be more confident about people and easier to train because they are less frightened when they have an outlook that allows them to view you approaching the pen. Also it will give you a easier observation of the birds, health and behaviour, and their good looks. Problems such as feather picking of the vents that shows up as a blood stained back side are more visible.

Use durable timber such as treated pine, you may plan to only use the pen for 5 years and end up expecting it to last for 30 years after you have used it for 10 years. As old age approaches you’ll want it to last another 20 years or maybe forever.

Use 5-6’ treated pine posts buried 650mm in the ground they resist snapping when old as the 4-5” tend to crumble in the centre, and break easily after 5 years.

Don’t skimp on roof timbers, remember they will stop you falling to earth when you are on the roof! Using F5 redried treated pine a 3m (10’) X 3m (10’) shed should have 190mm X 45mm end beams holding 120mm X 45mm rafters. They may seem expensive but hey, what does it cost to have a broken ankle from falling through a roof?

Use screws that have been coated for use with treated pine they will last longer and allow for easy removal if needed. Nails seem to work loose over several years, it appears that the wood dries and shrinks away from the nails over the years and stop holding the materials together effectively.
If you want to chemically disinfect the pens on a regular basis, then a steel frame construction on a concrete slab is the way to proceed. From what I have read timber has a natural ability to kill pathogen that come in contact with them.

Bury the wall iron about 300mm into the ground to deter rats and foxes. An alternative to burying the iron deep is to bury it at 150mm and have loose bricks around the outside of the pen. Painted gal iron will last about 35 to 48 years buried in the ground.

Slope the roof to the rear (south) and have about a 600mm overhang of the roof on the open north side which has the door. Do this so that in winter you can shelter from the rain, and enter the pen without the rain draining down your back. As part of the effort to eliminate rats on the front and rear edges fixing of the roofing iron put a screw on each crest. It is a good idea to make the back rafter to serve as a wall rail as well, to save costs.

After building the frame fix the wire mesh first then fit the iron cladding.

**Perches**

Swinging perches can be installed so they can develop their breast muscles flying up to them and swinging. Perches are made from 75mmX25mm or 50mmX75mm timber painted with old cooking oil an hung from the rafters using 2+mm wire to reduce mite infections. Place the perches well above or well below head height allow for a build up of the litter so your head is not used to batter the perches. If housing several cockerels together have lot of perches particularly swinging ones because cocks will not fight while standing on a perch, and they become a refuge for the loser. There is the added bonus that the birds build up their muscles from swinging on the perches.

Use a heavy gauge wire to swing such as 2mm to 3mm to hang the perches finer wire breaks from the fatigue of swinging. Take care to finish off the wire so that birds don’t hook their body parts on the end of the wire.

![Tie off of the perch in a way that birds cannot get skewered and hang by the wire.](image)

**Doors**

Make the doorway about 700 to 800mm wide so you can carry boxes of birds in or out, and be able to shovel litter out. You may want to push a wheel barrow through the door in which case the door way needs to be at least 875mm wide. Set the upper hinge out of plumb in the direction that you want the door to swing when not latched e.g. to have the door open into the pen set the top hinge about 5mm inward from the vertical. That could be handy if you want the pen to remain open when the chooks are foraging. A door closing spring or self closing sprung screen door hinges can be used to persuade the door to close after you if you are forgetful about shutting doors. It is better to swing the door with hinges on the LHS (if you are Rt handed) into the pen to control the bird movement however with small pens there is no room for a door so they have to swing out.

If oiling the 100mm or the scotch tee hinges each year seems like a task that won’t happen then fork out for brass or stainless steel.

I use 100mm long shoot padbolts to secure the door (75mm ones wear out after about 15years) The knob is below and clear of the wood for ease of opening open and closing. Also make any hole for the blot a vertical
slot to allow for post movement. Any catch that is used must be able to be opened or closed using one hand.

A type of shot bolt that works well

A handy internal door latch can be made from a block of wood 25x70x300mm with a screw or nail in the middle will make a butterfly catch to hold the door closed in the inside and still allow it to be opened from the outside using a catching hook in through the door edge to open the latch. They have a problem when used on the outside, a dog can jump up and open them.

A latch made from a bent piece of wire.

Note the wire staple level with the pivot point that holds the latch up while the door is being opened.

The piece of lamiae panel is so messages and notes can be left for other people who are caring for your chooks.

Have a door sill that is about 300mm high. This will discourage birds from rushing out the door, particularly chickens. There is also the bonus of avoiding litter jamming the door when closing. A door opening inward can be a problem when the dog digging for rats piles the pen litter against the door, one solution is to let the chooks out while the dog digs. If the dog has piled the litter against the door try to kid the dog that there is a rat in the heap by wiggling a stick or wire in the heap.

To prevent cocks from fighting between pens and birds outside the pen the lower 300-450mm of the meshed sides should be gal iron to obscure their vision when they lower their heads this will interrupt any battle that occurs. It is not uncommon for a cock to cut off toes on the wire when fighting between pens. Also it will reduce drafts in winter that will have a chill factor on the birds particularly the young chicks fresh from the brooder.

The mesh should be 25X25mm or 25X75mm square made from a minimum of 1mm diameter wire to exclude sparrows and foxes. Foxes have been known to tear open lighter gauge wire. When I used 50X75 mesh a fox decapitated the ducks that stuck their head out of the pen. To remedy that a piece of 12.5X12.5mm mesh has been added to the lower 600mmm of the pen.

Young chickens can get through 25mm x 25mm mesh, and can be a problem when raising chicks naturally.

The mesh should where possible be mounted clear of the pen litter otherwise it will quickly corrode in about 5 years.

Fix the mesh into place before screwing the iron cladding in place. To save your fingers from bruising, use a pair of pointy nose
pliers to hold the staples when fixing the mesh to the timber. Or use a staple gun. Take care to cover the wire ends or fold over the wire edge next to a doorway so that you don’t catch you clothing going in and out of the pen.

The size of the pens depends on how many birds are kept in each pen. Stocking at 3 birds per m² to me is a maximum and leads to the litter clumping to a hard surface when the litter can no longer handle all the moisture. Usually one bird to 2 m² is a good ratio. The pens should be a least 1.2m wide to allow the birds to move freely around the pen and bypass a person in the pen with them. Also the 1.2m will allow turning around with a fork full of litter in hand without hitting the wall when cleaning the pen. The floor can be concrete or earth either way the iron on the walls needs to be at least 300mm into the ground. Gal iron seems to last 30 years in most soils after that who cares? If you have a acid soil mix some garden lime in the back fill it will be helpful to extend the life of the iron

When building portable pens a rectangular unit about 1.5m+ high is the way to go. Triangle arcs or hutchies do not allow the birds to pass each other easily and are difficult to build.
To stop foxes and dogs digging into the pen a row of bricks loosely placed around the edge will deter them because when they dig the bricks fall into the hole and that deters their efforts.

Litter
Dirt floors need to be dug over regularly to discourage mice and rats by changing their habitat. The German short air Pointer does a good job of such a task with great relish for the occasional mouse that is dug up while turning over the litter. The constant changing of the rodents environment disorientates the rodents and they move to calmer digs. After the litter has been turned over, the chooks have a great dust bath. Dogs can be trained not to kill chooks by taking it with you every where around the pens while on a short lead, after about 4 months the chooks are no longer a target for killing. After such time can be safely be left in a pen with chooks while the dog goes ratting. Sawdust and wood shavings are my first choice for litter because chook manure has an excess of nitrogen, and wood particles require a high amount of nitrogen to decompose. They are made for each other! Timber has a natural ability to eliminate bacteria, and using course sawdust for a litter helps to reduce pathogens.

However rice hulls, shredded paper, peatmoss, horse manure, chaff also make a acceptable litter. But I have never seen hay or straw make a good litter. After a year or two the litter becomes a very valuable compost for the garden.

To move the used litter into a wheelbarrow or such I have found that the best implements are five prong potato fork or a ”spade” fork both with the prongs about 40 mm apart.

www.oska.com.au, Sell 5 prong forks with long handles only.
Aust Poultry vol22/4 p12 Resourceful Litter
Aust Poultry vol23/1 p14 Easy Deep Litter

Feeders
A easy to construct feeder from wood is shown in the picture

![Photo of wooden feeder](image)

A simple feeder can be made from a durable tube such as plastic sewage pipe and a bottom from an old hub cap. All held together with wire and hung from the roof beams.
BEHAVIOUR OF CHOOKS

a) Their Behaviour In General

The instinctive wild behaviour of chooks is always just under the surface.

Like all domesticated animals in nature, they are gregarious and live in groups that have a hierarchy and don’t like to be alone. So when separating birds to say a show pen for the first time put two birds in one pen for the first couple of days.

Come dusk chooks return to their roost to spend the night. To encourage new birds to return to the pen as their home, keep them locked up for a week before letting them out to forage. Use wheat thrown into the pen late in the afternoon to entice the birds into the pen. A plastic leaf rake is a very handy aid to shepherd the slower chooks home for the night. Mollie the collie is a great help.

Don’t forget to lock the birds in each and every night, because the one night you miss, the fox won’t mess about if they are found! Chooks are very easy picking at night.

Chooks mainly communicate to each other by making and listening to sounds. They have their own language that ranges from a soft I am here or I’ve just laid an egg cackle to a loud squawk that alerts all those around them to a danger. Cocks usually crow when the danger has gone, as well proclaiming their territory. The cocks cluck to announce good food and many other things are done while the hens are bent over to consume the food. Whenever I approach the pens the cocks make a gentle Akaka-dock-dock-dock almost like a greeting or is it some sort of announcement to other birds that I am around?. I have found that making the same Akaka-dock-dock-dock when approaching nervous birds seems to relax them. However if they are alarmed or upset an almost identical call is shrieked out loud. Chicks have a high pitch beep to indicate that they are young, also
they mutter quietly to each other when they are settling together for the night. Like all animals sharp loud sounds like scraping shovels or dropping metal bin lids on concrete will startle birds into action. Their first reaction to a loud sound or a quick sudden movement is flight without any thought of where to go. If there is no escape route then panic sets in for a while, when the movement and sound stops the birds settle down to a high alert state of mind and they look you in the eye to assess their situation. Terrified chicks in a brooder can ram themselves into a wedge behind a drinker or post or such and not be able to release themselves. One startled bird squawking can set off all the birds that are within earshot into panic mode. The larger the number of birds that are together, the more likely that all of them will be spooked into action. The closer you are before the birds see you the greater the panic just stand still until they settle. The birds can recognise individuals both poultry and human, they will be less startled by familiar people. The way to relax the startled birds is to freeze until calm is restored. Playing music like ABC Classic FM or Jazz seems to desensitise chooks to people sounds and soothe the chicks.

Walking towards the birds tail will make the bird move forward in comfort, move towards the head is confronting and they will turn around and the move quickly. Approach directly to the eye from the side and the birds become nervous and they will move in any direction.

Toss wheat so that it hits the chooks they soon lean they can cope with sudden movements. Chooks can be enticed to overcome their fears of people by only feeding just enough twice a day. They quickly learn where the food comes from and pay a good deal more attention to you.

Stressed birds perform badly. They gain weight slowly, get sick easily, produce less eggs, are harder to catch, in general they just feel unloved. Some birds at the bottom of the pecking order seem to develop a victim syndrome, often they are the one that are vent picked. Move them as soon as possible to another pen with younger birds and prevent another death.

Part of criteria by which I select birds for breeding is whenever possible to go for the easy handling birds, and leave the flighty and fighty ones for sale or the pot. Ref Aust Poultry Vol 10/1 p12 Poultry Behaviour.

b) The Laying Patterns Of Pullets Is According To What Month They Are Hatched.

Hens moult and replace their feathers and stop laying about Autumn (February / March). The fast mouling birds lose a lot of feathers quickly and look awful but are usually the earliest to start laying again. The neatest looking birds are at the top of the peck order and have not been knocked about by the cock mating so consequently they have probably not produce many fertile eggs.

Pullets hatched April / May will start to lay in November / December and moult over summer. The cockerels can work earlier say about October/November. The one advantage of these chicks is they can produce two generations in one year. These early chicks that are hatched when the cock is less fertile will produce more male than female chicks. Because the cocks are not good at producing sperm in this period the hatchability of the eggs is usually considerably less than in spring.

Pullet chicks hatched in early spring August / September (before September 25) will mature and start to lay towards the end of summer about mid February / March when the older birds are moulting. There is usually a equal proportion of males in these hatches.

Pullets hatched in late spring / early summer (October – December) will probably not start to lay until mid winter / early spring.
(June – July) when the days are getting longer. There is usually a greater proportion of females in the hatches made during this part of the season. Eggs set in January / February will produce pullets that will lay in July when they are five months old.

c) Pecking Order

In any group of chooks there is a social order that is established by pecking. This can occur in as little as 5 minutes or as long as 3 days. The smaller the group the quicker it is established, but in groups of more than 20 it may never be completely established because the birds can only recognise about 20 other birds. The males will have a separate order to the females. The female at the top of the pecking order is less likely to mate and produces fewer fertile eggs, she will look immaculate without a feather out of place while the hens with hardly a feather on their back and head are the roosters favourite producing many fertile eggs. The most dominate male may not be the most fertile. The usual results of three cocks running with a large group of females is the most dominate produces 70% of the offspring’s while the least dominate produces vitally none.

Provide several perches because birds do not fight on when they are on perches.

Birds raised in a brooder do not have an established pecking order and don’t seem to develop one until put in a pen together.

A young birds fresh from a brooder when added to an established group could be killed by the constant pecking it receives because of its naivety of the rules of pecking order.

Ref Aust Poultry Vol 10/2 p5 Poultry Behaviour.

d) Broody Hens

Clucky hens have a very pale comb indicating that she not sexually receptive. The only time that hens are aggressive is when they are clucky and raising chicks. Leaving eggs in the nest will encourage hens to go maternal and want to sit. Some lines of birds have had this inclination breed out like jap quail.

To move a clucky bird do it at night and put a hessian bag over the entrance to the new nest for a couple of days. Make sure that the new nest has been dusted for lice

Mark the eggs that you set with a 5B grey lead pencil so you can identify any new eggs that have been laid in the nest

Remove deep bowls of water when a hen hatches chicks to prevent drowning the chicks. But provide shallow water for the chicks and hen.

Aust Poultry vol22/2 p33 The Secrets to Setting Eggs,

e) When Cocks Are Aggressive To People

There are cocks when with hens become so aggro that they will take on anything, anybody any size they know no fear. It’s hard to feel safe when you don’t know when a large cock will be flying at you. It has been recorded that serious infection can be caused by the wounds that has been inflicted by their spurs. Do not dally, cut his spurs off immediately. To do this use a 4” grinder the grinding seals any blood vessels cut. Long spurs can be shortened by twisting the ends off. Otherwise use secateurs which may cause sub-lethal bleeding, but in no way is it safe to leave the bird with spurs. These cocks seem to sense when a person is afraid of them and some take advantage of that fear. So they are more likely to attack a timid person that they see as an animal weaker than themselves. They front up a full frontal, stand steady and stare at you looking for a
fight when you enter or leave a pen. Sometimes they give no perceptible indication that they will attack, often they will crow immediately you have left the pen. An agro cock might fly up at the door after you have left the pen. The next time it maybe at you they fly up at while you are in the pen. However feeding the pen before entering can often distract the cock. Don’t turn your back to the bird, particularly when leaving the pen. If the bad behaviour is ignored they will continue do it every time, it has become a learnt action and you can never trust him again. Once he has decided that he can attack it is impossible to reverse the action. They only attack me one time and when they stand their ground as they usually do, they are an easy target so I dong them, then and there on the head with the feeding scoop. There is just no reasoning with an agro cock. So learn to watch out of the corner of your eye for these birds and whoop them hard when they have a go at you.

An alternative action is to catch the cock and hypnotise him and lay him on the ground in the pen, and a soon as he gets up catch him again and hypnotise him again and leave him on the pen litter. The hypnotised bird has gone into a defence posture from a predator.

One lady told me that she pushed an aggressive cock with a stick but he kept attacking. I advised her to hit it hard and she did, the result was the problem was solved.

Cock birds need to have enough aggression to be able to mate, but not that much that they attack people. Some cocks have it in their nature to be so aggressive, and should be breed from only as a last resort as these birds tend to sire aggressive cockerels. Selective breeding can eliminate agro cocks. There is no pleasure in keeping aggressive cocks, and where possible should not be tolerated in the breeding pen. If a cock has been raised a pet it has a learnt a behaviour, where it sees people as rivals at mating age.

Under no circumstance let small children near the aggressive cocks.

Use a spoon on a stick to pick up eggs so that your face is not in the attack area.

My father-in-law had a neat way of handling such birds, he always wore a soft peaked hat that he put on the cocks head when he entered the pen. Collected the eggs while the blindfolded cock walked aimlessly around, then retrieved his hat on the way out of the pen

Aust poultry vol22/3 p15 Feisty roosters
Aust Poultry vol22/5 p28 Fowl Thinking.
Aust Poultry vol24/2 p24 Rooster Danger.

1) How To Hypnotise A Chook

Lay it on its back hold it still covering his head for 30 seconds. Then run you hand along its breast to the beak and keep moving your hand away from the bird in the same direction away from its head do this 3 or 4 times. The bird will lay there for some minutes before getting up.

There are other ways to hypnotise such as put the birds head under its wing and gently rock the bird back and forth then gently place the bird on the ground. The bird going into a fake death is a defence action to fool a predator, by hypnotising the bird you have become a predator.

To calm a bird that has been caught stroke its back with a flat hand or under the chin on its wattles or put its head under your arm so it can’t see anything.

Aust Poultry Vol11/1 p8 Sense of Smell in Poultry.
a) Fox Facts
It is estimated that the fox population per square kilometre is 4 in the country areas and 10 to 20 in the city areas or about 7 million in Australia.
Foxes can travel anything from 9km up to 16km in each night and day.
Foxes have been found to eat 24 different species of animals including foxes cats birds penguins as well as fruit like grapes and blackberries.
Foxes are skilled climbers, they can climb a 6 foot mesh fence.
Foxes have no trouble to dig a hole or push under a fence that is loose at ground level.
Foxes can jump clear over a 1200mm electric fence.
Foxes can squeeze through vertical bars 75mm apart, and a hole 180mm wide X 85mm high.
Foxes can kill a bird in a show pen with wires at 50mm apart but can not kill when the wires are 25mm apart.
Foxes have a back that is as flexible as a cats,
Foxes have semi retractable claws.
Foxes can pounce on prey.
Foxes have slit iris and reflectors behind their retinas so light passes the retina twice for better night vision, this goes along with an acute hearing and sense of smell.
Foxes have sensing whiskers on their nose and feet
Foxes are more like a cat than a dog and if they meowed they may well be classed as such.
Foxes weigh in at about 6 to 10Kg (the size of a large cat) and have been known to carry off a goose that weighs 10 to 15 Kg.
Foxes can run at 51 km/h.
Foxes prefer creeks and roads for hunting.
Foxes use hollow logs and culverts for dens.
Foxes will return to abandoned dens after a considerable break.
Foxes are not called the sly old fox for no good reason they are skilled hunters with a great aversion to making contact with people but observe their movement habits.
Foxes will plan ahead showing considerable intelligence and forethought and may visit several times observing people routines before making a kill whenever you leave a pen open.

Foxes only breed once a year in late winter to produce about four weanlings that disperse in autumn and cause havoc on unsuspecting poultry keepers. The population of foxes more than doubles at this time of the year but the available food doesn’t double. Hence, the foxes take greater risks and invade any place that provides a possible source of food. To them its either take the risk or stave.

When a fox robs the chook yard they will often kill many more than they can carry away, rumour has it they drink the blood of many of their victims others believe they kill for the fun of killing or are they planning to return to collect the others and bury them in a cache for leaner times?. As for the poultry keeper losses are always felt much greater than gains. To lose 10 birds out of 500 is a lot different to losing 10 birds out of 12. Nearly everybody can accept a predator taking a chook for a meal if they are carless to leave them out, but a pen full killed and left is seen as just despicable. At night in the dark and as long as the birds are handled gently and they don’t squawk and catching the birds is like picking up fruit. No wonder a fox can clean out all the birds in a pen on a moon lit night.

A pair of geese is venerable to foxes, but a gaggle of six or more is more than a match to a pair of foxes.

The only way to stop these industrious predators is to build a secure pen, which has a wire mesh roof or electric fence both top and bottom. The surrounds must be clear of long grass that provides excellent cover for them with their camouflage fur. Then every evening as dusk comes around automatically think ‘have I locked up the chooks?’ I say this because I sell a lot of culls to replace birds that have been raided by a fox after someone forgot to lock the gate.

Being in the city does not give the birds
immunity, foxes are skilled and versatile they have adapted to the city environment doing things like using graves for dens.

Use mesh of at least 1mm diameter wire. Foxes will tear a hole in lighter wire meshes in particular the hexagon mesh is not a effective barrier. The mesh must be small enough that birds cannot put their heads through for a fox to bit off and at the ground level be too stiff for the fox to push under with an out rigger of about 300mm,. To resist both rats and foxes the galvanised irom walls of pens need to be buried 300mm into the ground. I have found that with any pen that a layer of loose bricks around the outside edge confuses and deters the foxes digging because as they dig the bricks fall into the hole and they give up.

Chooks can be trained to enter and leave a pen via a high entrance which has a series of spaced jump up perches to make about 700mm steps on the inside and the outside of the pen that have a similar arrangement. The birds quickly learn from others how to access the outside world and return to safety for laying and roosting in the evening. The system seems to fool foxes. However foxes have been known to climb ladders.

Ref to Aust Poultry vol23/1 p10

Maremmas the Italian sheep dogs are from what I have heard are very good value in deterring foxes but they are not a pet but a working dog and must be trained properly. Maremma Rescue Victoria run by Ms Jacqueline Zakharia of Bambra area about 30km east of Colac charges about $350 for a rescued and assessed desexed dog.

www.cawoodfarm.web.com

Peter Fitzgerald trains and sells young trained Maremma dogs for about $1000, he can be contacted on Ph 0428112295 or 03 9016 4295

“Foxoff” baits are available from government agencies but only under strict supervision.

Rubber jawed fox traps are effective in catching foxes and other animals unharmed. Cage traps are virtually useless when it comes to catching foxes, they are just too clever to be fooled by such a contraption. One way to move the odds in your favour is to disguise the human sent by using vanilla essence spray on all the surfaces that you touch.

Whenever there is a bounty paid for fox scalps there will be considerable less demand for sales of replacement stocks from backyard chooks keepers. Bounties may slow them down but in very few of the countries that where it has been offered has the fox ever been exterminated. There are a few islands that have eradicated the foxes, and at the present moment Phillip Island with its penguin colony is down to about 60 foxes and the battle still rages. Tasmania has been fox free up to now. However, their government is spending millions on a fox scare.

Ref Aust Poultry vol22/2 p21 Fox Control & vol22/3 p26 Fox Control Strategies

Ref Aust Poultry vol25/5 p30 Novel Fox Security

Ref Aust Poultry Vol 17/1 p 18 Foxes and poultry

www.animalcontrol.com.au

b) Rodents

Rats and mice have lived with humans for thousands of years, they are clever animals at finding a niche with us by salvaging the bits of food that we drop and leave about. Well what can you expect, we provide them with food water and shelter from the cold, of course they think we are good to live with as we occupy the space during the day and they use it at night, and they have no intention of leaving, unless they are forced to go. The best that can be done is to reduce their numbers significantly.

The amount of feed available is a major driving factor for how many rats and mice breed at any place. A pregnant mouse consumes about 5g or a teaspoon of feed a day. That’s not much but 100 mice will eat
½kg a day or 15kg a month! A rat consumes about 30g a day much so 22 rats will eat a 20kg bag of feed a month! I don’t know about you but I buy food for the chooks not the rodents. Small amounts of spillage can be important. Store all feed in rodent proof bins, and have some method of cleaning up the little bits dropped by having as a loose hen or two that are always hungry. Over feeding the birds not only adds fat to their bodies but leaves a smorgasbord of food for the rats, so I only feed out what is consumed well before dark. This leaves little for the rodents making baits left out more attractive.

Usually the first indication that rats or mice are present in numbers is the smell. Also they can’t help themselves they must leave a distinctive sent markers to secure their territory and the telltale mini cigars of poo. Rats have poor sight and do most of their movements travelling well worn and scented paths, using their whiskers to guide them and leaving a trail of fat from their stomachs. To see if and how many rats there are look for the grease marks on the roof timbers, and at about 10 PM check out the pens with a strong torch. They are excellent climbers and have no difficulty running up a brick walls trees etc.

If a population of rats have been killed another family will move in and use the same “rat” paths. It has been recorded that rats can travel about 200m - 300m to a new site and use the previous rat population’s paths. They can jump up 700mm and across 1200mm and go through a hole 30mm diameter as well swim for two days and cross a kilometre of water. So the best you can hope for is to keep the numbers down by making them unwelcome.

I bait the roof of my house each autumn to discourage rodents, don’t be alarmed, something like 90% of all houses have them in the roof cavity at some time. As winter approaches and food becomes scarce, rodents seek warmer digs and places like pens sheds, and houses are often worth the risks.

Rats and mice don’t have a mutual love for each other. Usually there is one or the other. Rats weigh in at 300-600g whereas mice weigh in at 30-60 g. Both have a gestation time of 21 days and can produce about 6 litters of 8 in a year i.e. 48 young a year that’s not counting the young reproducing at five weeks old. Left uncontrolled the numbers are enormous.

Rats co-operate and care for each other, and they will try to rescue a trapped rat and learn about traps when they see a rat caught in one. Mice are more adventurous than rats and are easier to trap. Whereas rats are very wary of any changes to their environment and may leave bait alone for several weeks before eating.

It takes 3-5 days for TALON rat poison (0.05 g/kg brodifacoum) to work so baiting once a week with small amounts of bait is the way to be economical. It takes 1g to kill a mouse and 4g to kill a rat. Take great care with rat poison, don’t breath in the dust, use gloves wash your hands after being near the stuff. Anything that eats a rat or mouse that has been poisoned is also at risk of being poisoned but will probably not be a leathal dose. I have observed a dog spit out a rat that has been poisoned. I know of a poultry keeper who trained her dog not to eat any mouse that it killed by always having treats in her pocket to give out for any mouse presented. The antidote is an injection of vitamin K.

To read more about the affects of Brodifacoum Google on the internet.

A good way of making a bait station for mice is to cover the bait with a short say about 600mm of galvanised corrugated roofing iron with a couple of bricks to weigh it down. Another Bait station that I saw at the Melbourne Zoo was made from treated timber with a 75mm X 75mm tunnel and a removable cover in the centre that wedged into place. The setup meant that the bait placed in the centre was not carried out on th the rats feet.
The best trap for rats I have five of these in action and average three rats a night, that is about 1000 rats a year. I reset them in the same position every time, I do not remove their droppings or clean the space around the trap. I bait them using some chook food usually the greasy fatty parts. Sometimes a trap is not successful for a couple of nights but left on one of their paths it will regularly trap time after time and it is your duty to check them every day.

These “big cheese” rat traps have been made using the same design as possum traps. The rats stand on the platform to eat the food and wham the door drops down and they then become a candidate for under water swimming competition in a bin of water.

The trap on the left has been covered with quarter inch mesh to try to get mice. The traps are available from BUNNINGS hardware stores at about $15 each.

Rats need a place to sleep and if there is a clear area all around the pens with no great collection of good stuff that would made a museum jealous discourages their presents. This is because rats dislike to cross open spaces to get to food or anything else. Put a screw in every corrugation to stop rats entering through the roof. They can get through a hole that is 30mm high X 40mm wide.

This is a hole created by rats to gain access to a pen, note the dark marks on the timber. To prevent such incursions every corrugation needs to be fixed with a roofing screw.

Mice can get through a gap of 11mm X 11mm so ½” X ½ by 1.6mm mesh is not mouse proof! However a 10mm gap around a door is in general mouse proof.

Dirt floors need to be dug over regularly to discourage mice and rats by changing their habitat. I have a trained dog for doing that. Store food in rodent proof bins with close fitting lids.

There has been a research that has developed a strain of rats that only reproduce males which would mean they would eventually die out, there has been a great debate about whether to release them.

Ref Aust Poultry vol.22/2 p31 Rodents are Coming
Very good ref Aust Poultry Vol 20/2 p10 Remove Rodents Now
Ref Aust Poultry Vol 10/4 p26 Rats and Mice.

RODENT CONTROL 101 by Tony Man

Research has shown us that Rats and Mice are colour blind and nearsighted and that is why they rely a lot on their sense of feeling
Rodent baits will come in either coated grain, pellets, paste, powder or wax block so depending on where you are going to use it will dictate what you should buy. If you are going to use a bait in and around your chook pens then you should only use wax blocks to avoid spillages and spreading of the other formulations.

Prior to opening your bait you need to put on a pair of disposable gloves. Why you say, I'm not going to eat it and I'll wash my hands afterwards. Fine, you’re not going to eat it but the rodents

Naturally when baiting in and around your pens the bait should be contained in containers that chooks, children, pets and other non-target animals can’t get into. And the blocks should be secured by either steel rod or tie wire so rats especially cannot take the baits away and either drop them or cache them. The baits should be checked regularly to ensure uptake of the bait or spoilage by moisture or snails/slugs in which case it will need replacement.

There is one other thing about 'bait stations' in that both rats and mice like to feel safe when eating. Out in the open they are vulnerable to predators however inside the 'station' they feel safe and are happy to stay and eat for a while. Also have plenty of stations in particular when dealing with mice because they won't consume their daily meal from one source but a lot of sources. It is one of their inbuilt safety measures you might say.

One final trick for successful baiting is to coat the bait block with raw linseed oil because after all the bait block contains grains and that is what the rodents have come to your chook pens for so make the bait that much more appealing, or you may have something else that you think is better, it doesn’t matter as long as the rodents go for the baits and not the chook food.

The last thing to be covered is poisoning be it direct or secondary. There is an antidote for direct poisoning (consumption of the bait itself) which is Vitamin K1 administered by a vet in case of accidental poisoning of your cat or dog. You will need to advise your Vet the brand and active constituent of the bait so the vet can administer the correct dose. Secondary poisoning occurs from the consumption of dead rodents by your cat or dog and is very rare because they have to consume quite a lot for it to occur but the antidote is the same. T Man
c) Hawks
Brown hawks will use low branches of trees to swoop on to and kill quite large chooks. They are protected so the only thing to do is to lock up the chooks, or trap the bird and relocate it a long way away.

Crows
Crows are very clever when it comes to getting eggs. Crows will take chickens and eggs they even go into sheds to retrieve eggs from an open container. Crows will kill starling young. The bang from a party popper or a gun will scare them off for a few days. There must be a reasonable number of them shot even though it is illegal in Victoria. I have been told that if a dead crow is hung around the others will move on to other pastures.

Ref Aust Poultry Vol 22/1 p14 Raven Mad.

Sparrows
Feeding a large flock of sparrows can be an expensive by-product of keeping chooks and ducks. As well they are carriers of many diseases that infect chooks. They quickly work out how any trap that is set works. The only deterrent is to reduce the feed available to them to near nothing. Wire mesh of 25X25mm or 25X75mm is impenetrable to most small birds including sparrows. They usually eat in the morning till mid afternoon so feeding late in the day will discourage them from hanging around but any leftovers encourages rodents.

Max Hedt 16 Burgess St Horsham 3400
T 03 5381 0844
maxhedt@internode.on.net
has developed an effective sparrow trap that keeps on working. This one cost me $60

This trap is 300x430x200h and has three compartments, 1) the entrance 2) an entrapment area 3) an area think they can escape and the exit door to retrieve the drowned birds. In 2 months we have caught 38 sparrows.

d) Lice Mites and Worms
Lice and mites can make a birds life almost intolerable. There are a few things that can be done to make the chooks life more comfortable.

For scaly legs: - the mite that causes the problem is drowned by applying a liberal covering of cooking oil over the legs of all chooks in the affected pen once then once again in 10 days. Use cooking oil because it is clean the old folks used sump oil. Once the mites have gone always oil any new bird's legs.

For body lice: - remove the feathers around the vent with the grey masses of eggs. Then dust the vent area with derris dust (rotenone) or tomato dust and then again in 10 days time. Be careful to wash your hands after dusting. Dusting the vents of the breeding birds to reduce lice can improve fertility. Dust once and again 10 days later because any lice eggs missed the first time will have hatched by then but not yet laid any eggs. And while you are at it pull out any excess of feathers around the vent that could interfere with the mating process.

For Red mites that live in cracks and under perches and leave a tell tale a grey coating on the underside of the perches. They climb on to the birds at night feed on their blood and return to the perch. Mites can run down hens in the mating season. The problem is solved by painting the perches with oil lots of oil to drown the
mites by blocking their breathing vents. Any oil will do I prefer to use used cooking oil from a fry-up shop, the old timers used sump oil or creosote oil, very messy stuff!

Worms cause the birds to lose weight similar to Mareks disease but will occur any time where Mareks has done its’ damage by six months usually as the birds reach maturity.

An old poultry keeper assures me that CYDECTIN (must be oral not the pour on form) when 5mL is mixed in 2L of water and given as drinking water for 3 days every 3 months to chooks will remove worms mites and lice. I use 1ml of the pour on CYDECTIN on the neck each bird without ill effects.

Ref Poultry Vol 10/2 p16 External Parasites in Poultry.

**TROUBLE SHOOTING THE INCUBATOR**

A great deal of effort has been made to produce a reliable trouble free incubator. But as with the best laid plans and efforts occasionally failures do happen.

When it does break down the incubator may have malfunctioned in one of these ways:

a) The fan is squealing or the heater is operating and the fan has stopped leaving the incubator running cold at about 70°F - 90°F (21°C-32°C). If the fan is not blowing after an extensive shut down flick it may work, but otherwise replace the bearings.

b) The heater has stopped and the fan is still operating and the neon indicator is not on at all. There is a fault with the thermostat.

c) Both the fan and the heater have stopped It may sound simple but if the incubator is not working check that the power lead is plugged in and that power is available. Check that the power to the house is ok, it has happened that cable from the pole to the house has an intermittent fault.

There may have been a power surge (eg lighting) that has blown fuses or the Surge protector built into the circuit board, a round disc near the input that may be a blob of charred metal. Simply remove it by clipping off the leads to the component, the unit will probably still work! But replace the variac as soon as possible. If there is earth protection on the house switch board it will trip until the variac is removed.

**TO REMOVE THE TOP WITH THE ELECTRICALS**

Usually the easiest thing to do is to unplug the power cord take the top of the incubator off by taking out the 7 brass slotted screws on the sides near the top. Push the top up from the inside to separate it from the body of the incubator. If it is difficult to remove use a broad chisel to ease the sides free from the top, Wrap it up in cardboard, tie it with hay band string and post to me. I will repair it a minimum cost and post it back ASAP.

However if you need ideas on how to repair the unit then read on

**a) The fan stops or is not operating correctly**

I have continued to use the same Australian designed fan because they can stand a locked rotor for a very long time. And they are repairable saving the costs of replacing the whole fan when they break down. Usually the only parts that need replacing are the bearings and the shaft (sometimes). It is very rare that the windings get burnt out. To check the coil unplug the fan and use a multimeter the coil will measure about 72Ω

Usually there is a whirring sound given out by the incubator for some time before the bearing completely breaks down. During that time, think about getting replacement
bearings or picking a convenient time to have maintenance done.

When the fan stops due to bearing seizure the incubator will only heat up about 20°C (68°F) even though the indicator light is still flickering and no air flow can be felt at the top of the door way with the door open.

As a very temporary measure, to make it through a hatch or until some bearings can be obtained. Add some oil to the top bearing. To do this go to the top of the incubator and into the middle air vent hole which is just above the bearing add a few drops of light machine oil or upper cylinder petrol additive. Give the fan blade a flick with a pen through the guard.

The bearings need to be replaced by an electrically competent person. This is done by first unplugging the incubator, then removing the 7 slotted brass screws on the sides at the top of the incubator. Lift off the top by pushing on the sheetmetal from the inside of the incubator. Then remove the sheetmetal cover by undoing the 4 x ¼W nuts and disconnect the earth wire as the sheetmetal cover is removed to expose the fan body. Unplug the fan and remove it from the incubator. Dismantle the fan and replace the bearings. Refer to the photos and diagram. Two large screw drivers are used as leavers will be needed. Some light oil and emery paper to clean off rust from the shaft will most likely be needed.

To remove the fan blade boss grab the rotor or the shaft with pliers and with the other hand twist the boss it will come away easily.

The top bearing (away from the blade) is most likely the one that has broken down. However it is recommended that both are replaced. The bearings are SKF 626 2Z /+50 (high temperature) or any equivalent, these are a standard size and are normally available as a spare part from Smart INCUBATORS or from the local electric motor repairers.

Note how the power wires to the motor come up out of the frame toward the fan blade. When reassembling it is important not to turn the frame over because it will make the fan rotate the wrong direction and the future hatches will be abysmal. After reassembling the unit check with a flap of paper that the fan is blowing out to the edges and sucking in through the grill.

Note that the bearing case to the mounting brackets are threaded to allow for easy assembly.

Diagram showing the arrangement of the motor used from 2005 to 2013
The assembly of the motor used from 2013

Note that the bearing cases are different with the lower one has built up mounting posts.

Note the orientation of the motor body which has the black wires emerging towards the blade direction.

This motor has been in use for 5 years.

After removing the bolts holding the bearing cases. Use a screwdriver to remove the bearing cases.

Disassemble the motor
The paddle boss can be removed by holding the boss in one hand and the rotor in the other hand and twisting to separate it from the shaft.
Clean the shaft using industrial steel wool and WD40 oil.

Use the vice to hold the back bearing then with two large screwdrivers to ease the top bearing free from the press fit onto the rotor shaft and away from the “C” clip.

The back bearing is released by holding it in the vice and using the large screwdrivers to leaver the rotor away from the bearing held by a press fit to the shaft.

A piece of 5mm rod bent over leaving a 11mm (7/16”) gap This is slipped between the old bearing and the rotor. Replace the nut on the shaft and tapping gently with a soft hammer remove the bearing. An alternate to the nut is to drill a 5/32” or 4 mm hole in a large bolt to make a punch that fits neatly over the thread and onto the shaft shoulder. Note the rotor is not gripped by the vice.

Details showing the clip that restrains the bearing to the correct place on the shaft.
The new bearings are placed on the blade end of the shaft.

NOTE The vice does not grip the shaft but closed enough to support the inner ring of the bearing.

The bearing is a press fit on to the shaft.

The back end of the shaft is gently tapped with a soft hammer until the bearing has been seated against the clip.

IMPORTANT The bearing can be damaged if it is hit or forced on the outer edge and its life greatly reduced.

A tube spanner that just fits over the shaft onto the inner ring of the bearing is used to seat the back bearing on to the shaft against the clip.

NB The shaft or bearing is not held by the vice jaws but the rotor is resting on the vice jaws.

Detail showing the tube only on the inner ring of the bearing.
Operating instructions

The rotor body should be about 3mm from each of the bearings. The shaft is a press fit in the rotor and can be moved by taping the shaft with a soft hammer.

To move the shaft the vice is opened so that rotor rests on the jaws without gripping the bearing. The shaft is then driven down through the rotor with a soft hammer. The bolt with the \( \frac{5}{32} \) " (4mm) hole is ideal to drive the shaft.

To remove the shaft use a pin to drive it out of the rotor from the end without the thread.

Reassemble the motor. Check that the shaft rotates very freely without axial movement along the shaft (up and down movement is not desirable) but the bearing cases fit neatly on to the motor body as side pressure on the bearings will cause excessive wear and shorten the life of the bearings. If the shaft does not rotate freely after tightening the bearing case bolts then slacken the nuts a little until there is free rotation.

Remount the fan as it was installed. DO NOT FORCE THE BLADE BOSS ONTO THE SHAFT BUT USE A NUT TO MOVE IT ON THE SHAFT so there is no force on the outer ring of the bearing.

Note that the power supply wire comes out towards the blade. The back of the fan body should be about 30mm above the plywood panel.

The air flow is up from the body of the incubator, across the roof and down the sides through the baffles to the floor. If it blows the wrong way very few eggs will hatch and the nut holding the blade will probably come lose.

If the fan rattles when powered up, check that the blade is clear of the wire guard and the mounting is secure. The bearing on blade side may be loose in the bearing case.
In such a situation a small amount of gutter silicon on the outside of the bearing will take up the slack.

When remounting the fan assembly locate a support bracket over a screw hole and loosely screw it in place, do the same with an adjacent bracket. The last two brackets can be located an all screwed down firmly.

Reassemble the motor as per it was see the diagram. Do not use force on the face of the bearings as they can be damaged.

Test it, the shaft should rotate very freely with almost no axial movement. Remount the motor with the blade on the panel checking to see that it will be in the centre of the sheetmetal hole.

Note the cable from the coil is towards the blade for the correct air flow.

Check that the fan is central to the hole in the sheetmetal so that the air flow is even down each of the sides.

Check that the fan blows the correct way. The air is drawn from the body of the incubator, and blown down the sides, You should feel the air blowing out the sides of the top when you check that it is operating OK. A tissue will give a good indication of air flow.

For your safety, be sure to replace the earth (green & yellow) wire connection to the sheetmetal cover when reassembling the incubator.

Check by looking from the side on across the assembled top, that the fan body is parallel to the top and there is no contact between the heating coil and the earth wire that is attached to the sheetmetal shield / baffle. IF the earth wire makes contact with the heating element and after the insulation melts and allows the earth to connect to the element This can cause a short circuit and an over heating problem. This is caused by the thermostat being bypassed and the heater being permanently “turned on”.

Also this will cause the ‘Earth Leakage’ of the house to trip if one is installed.

Fan motor parts for the Fasco "c" frame motor J06E8GM/S & Blades FBP150UBK (for 81 egg incubator) FBP190 UBK (for 162 egg incubator)

These can be obtain from
Smart INCUBATORS 03 5231 3156
Edington Agencies 07 3397 4575
WA Rewinds 08 9445 2422
Statewide Electric Motors 08 8362 5755
Arrow Electrical 02 4227 3088
BCB Sales & Service 03 9546 3833

As a last resort the fan can be replaced
Because the normal operating ambient temperature is 20°C above the normal room temperature a fan that can be run continuously at 37-6C temperature is required. I have seen a ceiling fan replacing the fan grill and the body of the motor turned over so that it blows instead of sucking and pushing the air up to the top of the incubator.

A similar motor is used by LEMCO and AIRFLOW 8" ceiling extraction fans can be mounted using the steel straps off the old one. Alternately a fan sold by Eaton Electric Systems Pty Ltd 10 Kent Rd. Mascot 2020 Ph 02 9693 9333 Sell the SUNON A2175HBT-TC fan shown mounted in the illustration

An annulus of sheet metal was riveted on to the baffle to accommodate the smaller diameter fan. The fan worked adequately.
b) The Thermostat stops working

The easiest course of action is to post the top electrical section of the incubator to Smart INCUBATORS for repair.

If the fan is operating OK then the thermostat can be unplugged and send for repair.

Get a electrically competent person to unplug the incubator and take off the top by removing the 7 slotted brass screws on the sides near the top. Lift off the top by pushing on the sheetmetal from the inside of the incubator. Then remove the sheetmetal cover by undoing the 4 x ¼W nuts and disconnect the earth wire as the sheetmetal cover is removed to expose the thermostat.

Unplug the thermostat and post it to me. A pair of pointy nose pliers are just the ticket to pull the plugs off. The wires will hold their position to give clues as to where they are to be replaced. Generally I will fix it a lot cheaper than other people. As an alternative a replacement thermostat is available, as a spare part to replace the faulty thermostat. This can easily be done by an electrically competent person. The faulty unit can be repaired and kept as a spare.

Since 1994 I have always used the same wire colours. The orange and purple wires are for the internal light and may not exist on your unit.

If however you are electrically competent and want some ideas that could help then read on.

Make good use of the circuit diagram included in these notes.

Be aware of that when testing the thermostat will only fire if there is sufficient load (100W globe) is connected. That is the nature of the output triac they will only fire if they have a resistive load connected to the output. To bench test a thermostat, connect a load (100w+ Globe). And the second sensor then use a hot air gun or hair dryer to heat the remote sensor until the globe goes out, when it lights up again apply heat to the sensor on the circuit board near the IC. The order is important so the IC near the sensor on the circuit board is not overheated.

If the screw heads holding the circuit board are rusted then expect some of the components have become stuffed from being corroded and need to be replaced. The components to look at are the sensors, the trim pot, fuse holders, the ten turn 20K pot and the fan bearings.

The suggestions are under the following headings

b1 The fuses are ok?
b2 When the unit spasmodically over heats,
b3 If the fan has stopped as well as the indicator not lighting,
b4 If the wire fuses have blown.
b5 The temperature fluctuates wildly

b6 The temperature fluctuates by slowly rising over a long time.

b1 The fuses are ok?
i.e. the fan works, but the indicator does not light up.

Does the heating coil heat? If so the neon indicator has died and needs to be replaced.

Does the heating coil have a good electrical connection. The triac will not fire up without a load!

Unplug the fan and measure the resistance across the triac thermals

i) MT1 to MT2 should be 3MΩ
ii) MT1 to G should be 150Ω
iii) MT2 to G should be 3MΩ
if faulty can be replaced with any triac that can cope with current requirements of the machine. (8A BT137) then test .

Check the d.c. & a.c. voltage across the 100 µF condenser it should be about 6Vd.c. & 0v a.c. If not check the 22KΩ resistor it may be open circuit, it measures 22kΩ and about 8.5V a.c. from neutral bar to end the goes to pin5 of the I.C.

If the 22kΩ is ok then the 100µF capacitor may have broken down, when the board has 240v ac connected there should be 6.3v dc and 0v ac across the capacitor. If not it needs replacing (preferably 125°C and 16v). (rarely breaks down)

Check the sensors there should be about 30kΩ across the two together. If one sensor has become open circuit due to corrosion the resistance will much higher and the incubator will only reach about 30°C (85°F) Max. Unplug the remote sensor it should measure about 100 Ω and the sensor on the circuit board about 60 Ω.

The NTC is 100Ω @20°C and is available from RS Components.

Check across the 20kΩ 10 turn pot (adjusted to ≈10kΩ) and the trimpot (set at ≈16kΩ using a multimeter). The unit will not fire if they are open circuit.(increase the trimpot resistance by about 1kΩ for 1ºC decrease in temperature). Over time the trimpot can corrode and cause the temperature to fluctuate in an irrational way.

A similar temperature fluctuation can be caused by a corroded potentiometer

If that is OK then the I.C. CA3059 is faulty. If there has been local thunderstorm activity or a power surge the integrated circuit chip (CA3059) may have been damaged and need replacing (a plug in job). They are available from Smart INCUBATORS, or search the web for availability. The local suppliers have stopped stocking them.

Always take a long hard look for a dry solder joint.

b2 When the unit spasmodically over heats,

and then after the unit has been switched off and restarted it seems to operate OK for a while then it over heats again. A clip-on heat sink on the triac solves the problem. What is happening is the triac which will only fire with a load over heats and locks on ignoring the signals from the gate and stays switched on until the power is removed.

Another possibility is a bearing is on the way out and as it gets hot and temporarily seizes only to allow the fan to operate when the cabinet is jolted. The incubator will take on the room temperature and on a hot day over heat. A bit tricky to pick! On a hot day when the fan has seized the temperature reading could be 40°C (105°F)

Take a long hard look for a dry solder joint on the circuit board

It is possible that the sensors have failed particularly incubators built before 1998

The trim pot or the main control potentiometer has failed.

b3 If the fan has stopped as well as the indicator not lighting,

Check the fuses including the thermal fuse, although they will rarely fail. Sometimes the internal light globe blows when it is switched on and causes a quick short circuit and blows the fuses. Replace the fuses ( 5A 1⅛” X ¼”dia) and all will be ok . Make sure the fuse holders have a tight grip on the fuses. When powered up there should be 240V ac all along the active and neutral bus to the output end.

Sometimes the indicator shorts out and needs to be replaced. The only way to test is to disconnect the indicator

b3 ) If the thermal fuse has failed then the incubator has over heated to 98°C (208°F) cooking the eggs, as well the thermometer may have a broken bead (see note at the end of Temperature Control section on how to fix it). After investigating and fixing the cause (probably the heating coil touching the earthed sheetmetal) replace the thermal fuse with
one that is set to fuse at 80°C to 100°C use a heat sink when soldering in the new fuse.

- The output triac could have broken down and shorted leaving the heater switched on continuously.

--Unplug the fan and measure the resistance across the triac thermals
  i) MT1 to MT2 should be 3MΩ
  ii) MT1 to G should be 150Ω
  iii) MT2 to G should be 3MΩ
If faulty replace the triac BT137 or any 8A triac.

Check the resistance of the fan coil (70Ω) while it is disconnected. Check that the heat sink on the triac is clear of the neutral supply to the fan.

- The 20KΩ potentiometer or the associated trim pot may have been broken and make the IC trigger the triac. Measure ≈25kΩ across the two of them together. The unit will not fire if they are open circuit. But an intermittent fault may start the I.C. and the triac and go open circuit leaving them continuously switched on.

- The heating coil has shorted to the sheetmetal and heated from the active side to earth of the sheetmetal baffle (Extremely rare but easy to see)

- The heat sink has made contact with the fan terminal and heater has a continual power supply and the incubator temperature will rise to a terminal state and blow the thermal fuse.

**b4 ) If the wire fuses have blown.**

- The fuse may have aged and broken.
- The neon indicator has shorted. The only way to test the indicator is to disconnect it and replace the fuses if the unit goes replace the neon indicator.
- The fan motor has broken coil. Disconnect the fan from the circuit board and check with a multimeter. Check the resistance of the fan coil (70Ω)(very rare)
- Water has leaked onto the circuit board. Remove the circuit board from the panel and check for black mark on the back of the board.
- The Variac has had a surge. If blackened check for shorting and if necessary remove the Variac, replace the fuses and try the unit. It will probably operate. In the mean time replace the variac with a 250V one with as much capacity as you can get as it may be the only one in the house and when a serious surge occurs it will short to the earth stud and protect many other appliances in the house.

**b5 ) The temperature fluctuates wildly**

- The 20k potentiometer or the 50k trim pot used to control the temperature may be faulty replace the trimpot first because it is cheaper, it should measure about 16k. The 20k pot should measure 20 k across the whole pot and the two parts add up to 20k. The 20k pot should be set at about 10k.
- Should the thermostat be working OK but settling on a temperature outside the desired range.

  This can be rectified by adjusting the trim pot (see photo below) It can be adjusted by turning it no more than about 5 min of the clock (30º) at a time to change the temperature by about 10°C (18°F) Turn it CW to increase the set range and ACW to decrease the set range. The resistance across the trimpot should be about 16KΩ when measured using a multimeter.

**b6 ) The temperature fluctuates by slowly rising over a long time**

- The remote sensor is breaking down and needs replacing 100KΩ NTC

**d ) How to modify the incubator to hatch reptiles**

to adjust the thermostat to work the incubator down at 29½°C set the trim pot at 19.5kΩ (increase the trimpot resistance by about 1kΩ for 1°C decrease in temperature) In the hot weather put ice in the water tray when the room temperature goes over 30°C so the incubator can control the temperature
to 29½°C. To have a temp range of 20°C to 60°C use a 50kΩ ten turn potentiometer and set the trim pot to 12kΩ.
BOOKS ABOUT POULTRY

I am often asked for recommendations on books for Incubation and other matters on animal husbandry. Apart from ordering books from your local book seller I have found a country book seller that had literally filled a house full of books on farm management and related subjects, he now has a basement full of books. His name is Jim Lowden and has since moved to Donvale near Melbourne you will find him at

THE RURAL STORE  29 Lisbeth Ave  Donvale 3111  Phone 03 9873 7202
-ask for a brochure and the possibility of obtaining any unlisted books that you are looking for.

An excellent magazine is AUSTRALIASIAN POULTRY  editor Meg Miller and is available from
Poultry Information Pub  PO Box 438  Seymour vic 3661  Phone 03 5792 4000
-they are good people to talk to about a subscription, back copies and ideas for articles on various chook topics.

It is cheaper to buy books on the internet. The best sites are WWW.fishpond.com.au and
WWW.amazon UK.COM but there are many others.

Here is a list of some of the more useful books

A GUIDE TO BETTER HATCHING by Janet Stromberg ISBN 0-915780-00-3
pub Stromberg Pub Co       about $20

PRACTICAL INCUBATION by Rob Harvey ISBN 0-88839-310-5
pub Hancock House pub Ltd   about $40

EXHIBITION POULTRY-BREEDERS HANDBOOK by Rick Kemp ISBN 0 864172338
pub Kangaroo Press P/L PO Box 75 Kenthurst 2156  about $20

SEXING ALL FOWL, BABY CHICKS, GAME BIRDS, CAGE BIRDS
. By Loyl Stromberg       pub Stromberg Pub Co       about $20

THE EMU FARMER'S HANDBOOK by Minnaar
pub Induna Co Groveton Texas USA       about $90

Wildlife Harvest Publications Inc  PO Box 96 Goose Lake Iowa 52750
Ph 0011 1 319 259 4000 fax 0015 1 319 259 4483
on Partridge pheasants quail etc.  $US 36.95 + p&p about $10 surface mail

HANDBOOK OF THE BEGIAN BANTAM CLUB OF AUSTRALIA
ed Irene Hannan 160 pages  about $40
from Irene C/- "mountain Veiw" Caparra via Wingham NSW 2429

PARROT INCUBATION PROCEDURES  by Rick Jordan  140 pages
Published 1989 by Silvio Mattacchione 1793 Rosebank Rd Pickering,Ontario LIV IPS Canada
I think it is out of print but Biblio Quest International
Reply Paid 33 PO Box 687 Bowral 2576   ph 1800 067 877 may be able to get a copy.

CREATIVE POULTRY BREEDING by W Clive Carefoot 200 pages
(only 500 copies printed for the 1st ed.) I believe that it has been recently been reprinted and is available from
The Rual Store for about $70

THE BACKYARD DUCK BOOK by Nyiri Murtagh  CSIRO Publishing www.publish.csiro  ph 03 9662 7666
STORLEY’S GUIDE TO RAISING CHICKENS by Gail Damerow 340 pages  about $35
Published by Story Books PO Box 206 North Adams MA  USA Written by a person who has great experience with poultry over many years.

A BEGINNERS GUIDE TO INCUBATORS AND CHICK REARING  by Jim Finger
Published by Bellsouth Publication  A sound book on how incubators in general work.
The Doyens of poultry Volumes 1 to 5  Published by Bellsouth Publication

GENETICS OF CHICKEN COLOURS by Sigrid van Dort  . David Hancox & Friends  225pages  about  $65
Available from David Hancox 29 Gundagai Rd Cootamundra 2590  ph 02 6942 2152

COLOUR BREEDING IN DOMESTIC DUCKS  by Mike and Chris Ashton  50 pages  about $35  Amazon.co.uk

KEEPING DUCKS AND GEESE by Chris and Mike Ashton  128pages  about $35  Amazon.co.uk

THE DOMESTIC DUCK  BY Chris and Mike Ashwood  192 pages about $45
Amazon.co.uk  or Crowood press.co.uk  or www.crowood.com

AN INTRODUCTION TO COLOR FORMS OF THE DOMESTIC FOWL  by Brian Reader  $60
Amazon.co.uk

The Wood Duck and the Mandarin  Lawton L Shurtleff & Christopher Savage  University of California Press
A very detailed study of the birds in the wilderness.

SOME INTERNET SITES OF INTEREST
www.natureform.com  www.hagen.com

SOME HANDY CONTACTS ON POULTRY STUFF
Diagnostic tests—Department of Primary Industries at Attwood ph 0392174300 for info

Electronic part CA3059  smart incubators or UTSOURCE via internet

WR & D Wells 144 clarendon St South Melbourne 3250  ph 03 9699 8999
Long Handle Churn Brush (dairy) blue softer for softer bristles and green for stiffer bristles

Fan motor parts for the Fasco "c" frame motor J06E8GM/S & Blades FBP190 UBK
Smart INCUBATORS  03 5231 3156  Arrow Electrical  02 4227 3088
Edington Agencies  07 3397 4575  WA Rewinds  08 9445 2422
Statewide Electric Motors  08 8362 5755  BCB Sales & Service  03 9546 3833
Or an 8” ceiling extraction fan motor can be mounted using the steel straps off the old one.
Propharma Australia  5 Elliot RD Dandenong 3175  ph 1800337 955  03 99794 7168
www.propharma.com.au  Premix manufactures  They produce a poultry breeders premix additive in powder form called P92 in 12.5 kg bags for about $170, enough to do most fanciers about a year which is the life time of the premix.
STOCKGAIN and MOIAVITE vitamin supplement in A molasses liquid form is available from most stock feed stores

Kurdeez Lime Pty Ltd Curdies River RD 3268  Ph 03 5595 0395  or 1800 660 120
a Chicken's Problem.

1. "Am I a people?"
2. "No, you are a chicken..."
3. "Do chickens come from people?"
4. "No, chickens come from eggs..."
5. "Are eggs born?"
6. "No, eggs are laid."
7. "Are people laid?"
8. "Some are... others are chicken!"
9. "?"
The then US Defence Secretary Donald Rumsfeld said in 2002,

"Reports that say that something hasn't happened, are always interesting to me because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns the ones we don't know we don't know."

Rumsfeld was lampooned mercilessly for that comment. Every year I find something to add to these notes as I have found something else to know.