# DETAILED RESEARCH GUIDANCE FOR INCUBATING AND HATCHING EGGS

Since the improvement in the efficiency of the forced air incubators using micro-computer technology, the use of the still air model is declining. This however does not alter the need for the person controlling the hatching to be fully aware of the vital areas of control that still need to be managed during the period of incubation.

**Selection and Treatment of Eggs**

The first consideration in the incubation process is of course the selection and treatment of eggs. There are three important aspects to address:

1) stock breed and its vigour – do not expect high fertility or hatch rates from a declining strain.
2) breeding stock health – stock must be free of any ailments, be in peak of condition and fed on best quality rations. This applies to both cockerels/cocks and pullets/hens.
3) storage of hatching eggs - they should be collected frequently to avoid unknown increases in temperature that could trigger the start of incubation, and they should be clean. If they do need a rinse, only use tepid warm water with a suitable mild disinfectant, and only a very short gentle rinse. They should be stored in a cool dark room and turned daily before moving them to a room temperature environment for several hours prior to transferring to the incubator. Here are the main optimal climatic conditions during storage:

| *Storage Duration* | *Temperature (C)* | *Relative Humidity (%)* |
|---|---|---|
| *0 – 3 days* | *18 - 21* | *75* |
| *4 – 7 days* | *15 -17* | *75* |
| *8 – 10 days* | *10 – 12* | *80 – 88* |
| *More than 10 days* | *10 – 12* | *80 - 88* |

## INCUBATING GUIDE

The following guide is based upon the conditions required for poultry eggs in all automatic incubators, but other egg breeds require very little difference.

**Temperature**

Maintaining the correct temperature is the most vital of all conditions to properly control throughout the hatching period.

The temperature control is in 4 basic periods:

(a) the pre-incubation period – when room temperature eggs move up to uniform incubation temperature,
(b) the front period (cell differentiation) with a higher temperature,
(c) the middle period (growth period) with a mid temperature, and
(d) the back period (maturation/hatching) with a lower temperature.

The pre-incubation period (a) (2 hours – 5 hours depending upon incubator type/size) – any dampers are closed so little or no air exchange in the incubator.

As the temperature increases to the set point, the internal egg temperature is also rising in an equal manner throughout the egg mass. Incubation actually begins once the setter has reached its temperature set point 38°C. This is the key to a narrow hatch window and uniform development of the embryos.
The 1st-7th day is the front period (b), when the temperature in the incubator should be 38°C.
The 8th-17th day is the middle period (c), when the temperature should be 37.5-37.7°C. It is divided into two stages – endothermic, when the embryo absorbs heat, (days 8 – 10), and then transitions to being exothermic, when the embryo produces heat, (from days 10 – 12, and then up to the end of the incubation stage). It is when the embryo transitions from an endothermic state to being exothermic, it is necessary to increase oxygen and decrease the carbon dioxide inside the setter by opening dampers when possible.
The 12th – 17th day is the late middle period when the temperature should be 37.5-37.6°C.
The 18th-21st day is the back period (d), when the temperature should be 37-37.5°C. Embryonic heat production will reach its peak at day 18. The embryo is positioning itself for hatching, and absorbing the residual yolk, so the temperature should be lowered to a maximum of 37.5°C. Where possible, increase the fan speed and open the dampers, whilst maintaining correct temperature. Transfer time can vary from day 18 to day 19.5. Temperature setters should remain at 37.5°C up to the end of hatching. It is only when the temperature in the incubator is kept within these guidelines that the embryos can successfully develop and grow.
If there are two batches or more in the hatching machine, leave the control at a constant temperature of 37.8°C.

Temperature variations can cause the following problems:
Too high a temperature can affect the growth of embryos; a higher temperature will decrease the hatching period and increase the death rate, and if the temperature reaches a constant 42.0°C, the embryo will die in 2 - 3 hours. Too high a temperature during the middle period will also affect the release of stale air from the egg, resulting in a big belly and long feathers.
Too low a temperature can also affect the growth; a low temperature can delay the hatching period and increase the death rate, but if the temperature is lower than 35.0°C, the hatching embryo will die in the shell. Too low a temperature can also cause more water in the body and short feathers.

**Humidity**
The embryos can adjust to a wider variation of humidity. In the front period, the humidity in the egg incubator can be 65% RH, especially in the first 2-3 days. It is critical to maintain an even and homogenous environment to ensure embryonic development continues evenly and rapidly throughout the egg mass. High humidity will slow the loss of additional moisture from the egg at this stage.
In the middle period, the humidity should be 53-55% RH. In the back period it should be 65% RH. In the pipping period (day 20) as high as possible. The correct humidity conditions in the incubator will benefit the hatching. In the front period, the hatching eggs need to produce amniotic fluid, in middle period, they need to release carbon dioxide, and in the back period, they need to chip the shell.

**Ventilation**
Proper ventilation conditions in the incubator will support good oxygen conditions. help to release the CO2 and ensure normal metabolism and normal physiology functions. Poor ventilation in the front period affects metabolism as the amount of oxygen will not be sufficient. Poor ventilation in a hatching machine in the middle period can also cause badly positioned and abnormal embryos that can even cause death. After the19th day, the embryo uses its lungs to breathe, so the correct level of ventilation, humidity & temperature is vital. The aim is to lose 15-17% of water from the starting egg weight during the whole incubation period (approximately 0.8 – 0.9% per day). When there is an apparent problem at this stage, first check the constant temperature and secondly the ventilation.

**Egg turning**
The main reason for turning eggs is to avoid the glutinous embryos sticking to the vitelline membrane. The blastula, (ball of cells forming the embryo) is sited very close to the vitelline membrane that encloses the yolk within the albumen. The embryo can touch this membrane easily, so when the position of the eggs is changed by the automatic egg turner system, the touch point of embryos and vitelline membrane changes frequently. The eggs need to be turned once every 2 hours. This will prevent the sticking together of embryos and the membrane. After the 17th day, they do not need to be turned, so can be moved to the hatching baskets.

**Egg Cooling**
The purpose of cooling eggs is to balance the heat levels, assist in the supply of enough oxygen for the embryos, and to improve health and hatch rates. Recent research has shown that cooling in the manner that most closely resembles the natural conditions of cooling when the hen leaves the nest to feed and exercise, does significantly improve the hatch rate percentage of chicks, as well as improving their general health and strength. The first 7 days in the incubator, the eggs do not need cooling. From the 8th to the 17th day, the eggs are cooled once every day. When it comes to the 18th day the daily cooling can cease. Every cooling can be for 15-20 minutes. To control cooling, just turn the electric control off and open the door of the egg incubator. This is the simplest and really is the most effective way of mimicking the natural conditions of the hen leaving the nest. If your incubator has an automatic facility for this function and you choose to use it, the cooling periods will need to be much longer, as the rate of cooling will be very much slower than simply opening the door. The cooling period for the 8th to the 17th day therefore will need to be up to1 hour once every day.

These guidance notes cover incubating control using the most advanced incubators, so it is not possible to cover everything with some of them.

## The vital figures that must be followed though are those for temperature.