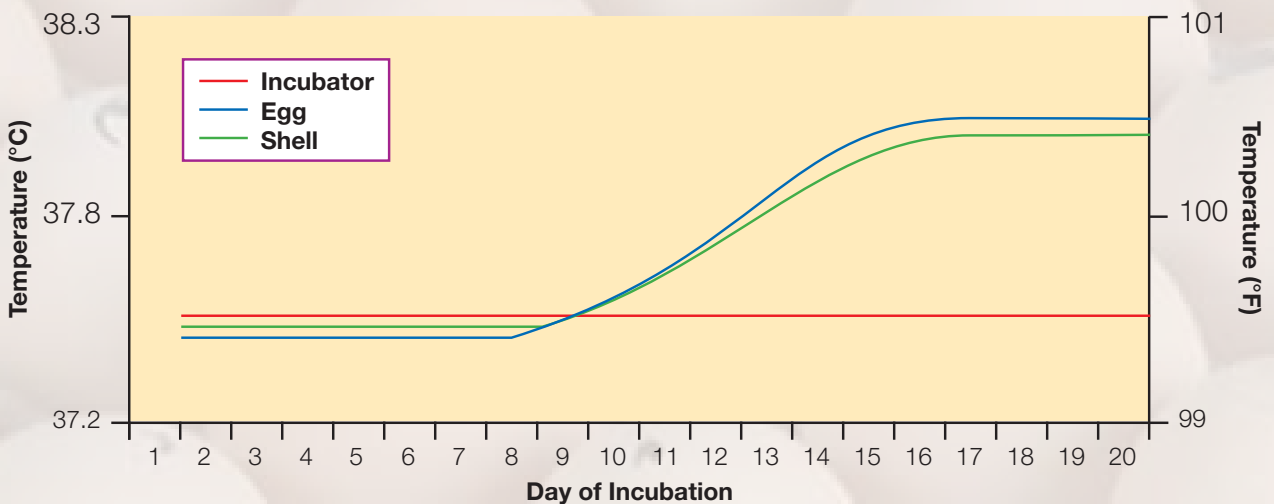


WHY MEASURE EGGSHELL TEMPERATURE?

- Correct setter temperature is critical for hatching good quality chicks.
- Setter temperature is what is experienced by the embryo inside the egg. It is not the air temperature of the setter.
- Eggshell surface temperature is closely related to internal egg temperature (see graph below). It is therefore a useful tool for determining whether or not setter temperature is correct.
- Shell temperature can be easily measured using a medical infrared thermometer.
- Optimum shell temperature for maximum hatch and chick quality is 37.8 - 38.3°C (100 - 101°F) throughout the whole setting period.

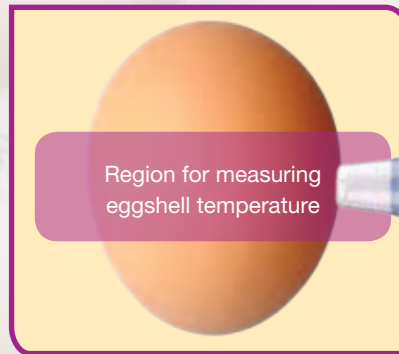
Measured internal egg and eggshell temperature during the incubation period when incubated at a constant temperature – based on Tazawa & Nakagawa (1985) and French (1997)



- Knowledge of eggshell temperatures allows setter temperatures to be adjusted to optimize conditions for differences in embryo heat production and machine design.
- Measurement of eggshell temperature should be used to establish the correct machine temperature setting for the type of egg that is being incubated and for the design of setter.
- It should not be used for calibrating setters or checking machine temperature uniformity.

THE PROCEDURE FOR MEASURING EGGSHELL TEMPERATURE

- The only equipment required for measuring eggshell temperature is a medical infrared ear thermometer.
- It is recommended to use a Braun ThermoScan ExacTemp (Model IRT 4520, type 6022).
- Correct region for measuring shell temperature is shown below.

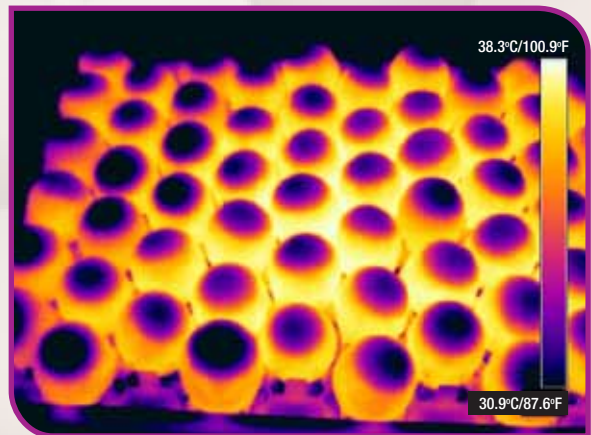


WHERE AND WHEN TO CHECK EGGSHELL TEMPERATURE



- The objective is to sample eggs within the machine from locations on the left and right, front and back and top, middle and bottom of the setter. The exact locations will vary with machine design but attempt to cover all areas of the setter.
- Do not choose trays at the very top or bottom of the trolley or rack.

- Choose eggs in the center of the incubator tray to monitor; those at the edges of the tray will be cooler.
- To get a complete profile of the setter, eggs will need to be monitored at each stage of incubation.



Thermal image of eggs on a setter tray. Note that the temperature of the air cells and eggs at the edge of the tray is cooler than temperature at the equator of eggs in the center of the tray.

Step 1:

Check that the measuring tip of the thermometer is clean and that it has a new plastic cover on. (Some older thermometer types may need to be kept at incubation temperature for 30 minutes prior to use to prevent an error message).

Step 2:

Plan where to sample eggshell temperatures before opening the setter door, so that it will be possible to work quickly once inside. Ensure each area of the setter is monitored.

Step 3:

If it is not possible to work inside the setter safely while it is operating, turn it off and measure as many eggs as possible in 10 minutes. If it is not possible to measure eggs at all locations within 10 minutes, close and restart the setter and return after 30 minutes to complete the measurements.

Step 4:

Measure shell temperature at the equator of the egg, not at the top or bottom. Make sure the tip of the thermometer is flat against the eggshell surface.

Step 5:

Sample 3 eggs from the center of each setter tray. For eggs in the second half of incubation, reject any measurement that is significantly cooler ($> 0.4^{\circ}\text{C}/0.7^{\circ}\text{F}$) than the other eggs on the tray as it is likely there is no embryo in the egg.

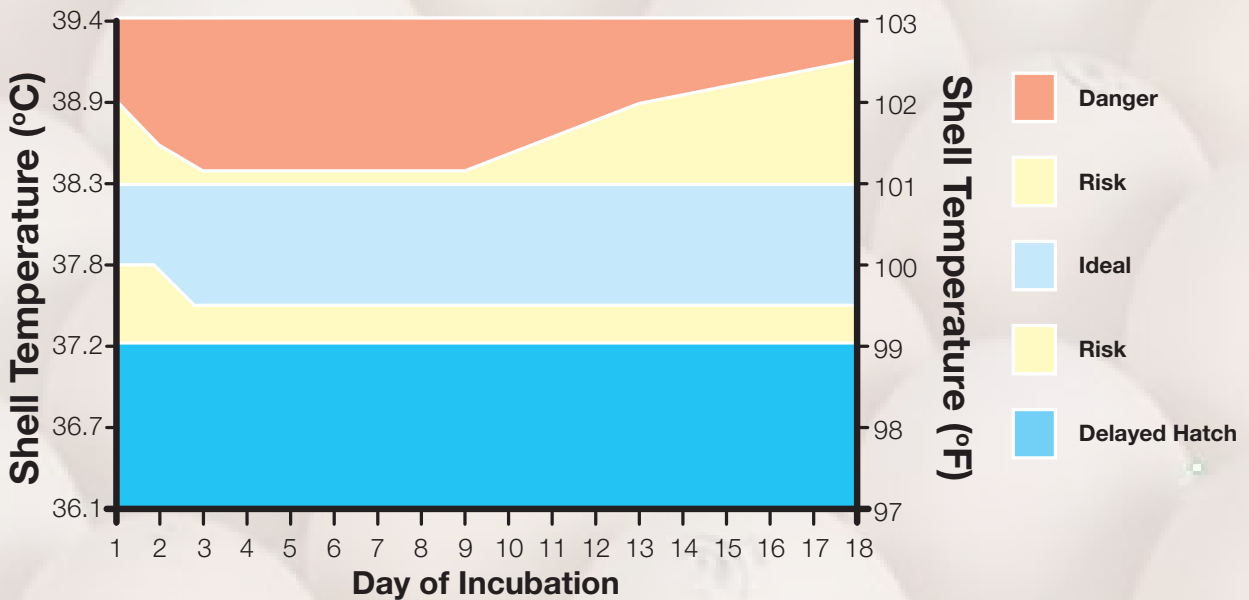
Step 6:

Record results. Determine average eggshell temperature and spread of eggshell temperatures.

Step 7:

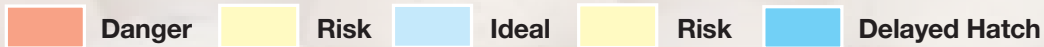
Compare results against graph opposite to determine if incubation temperature correct.

INTERPRETING EGGSHELL TEMPERATURE



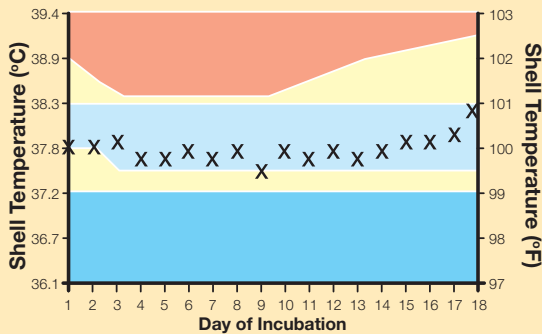
- The objective is for most of the eggs to be within the ideal temperature range (37.8 – 38.3°C/100 – 101°F) throughout the incubation period.
- In single-stage systems this is achieved by adjusting the temperature program at each age of incubation.
- In multi-stage systems where only one temperature setting can be used, there may have to be a compromise between the requirements for the start and the end of incubation. It is probable that at the start of incubation it will be necessary to have eggs cooler than ideal in order to ensure that eggs do not become too hot at the end of incubation.
- High incubation temperature is normally more damaging than low incubation temperature.
- If there is a wide spread of eggshell temperatures across one machine it may indicate that it needs maintenance.

EXAMPLES OF TEMPERATURE PROFILES

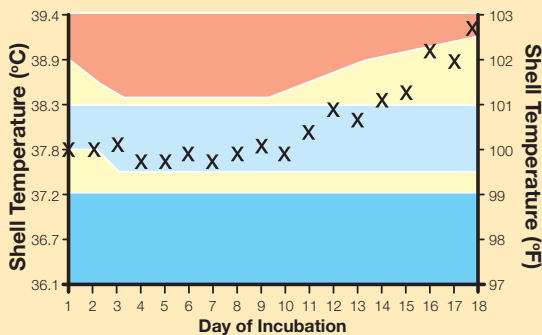


SINGLE-STAGE MACHINES

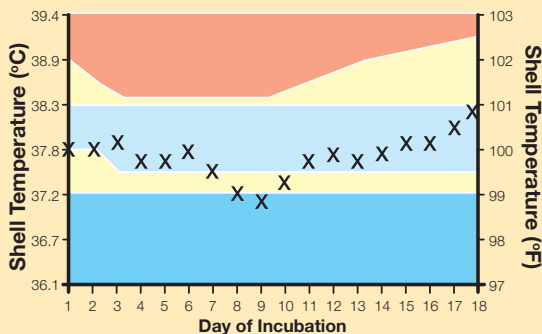
Note: Prior to any alteration of setter operating temperatures, ensure that there are no maintenance problems with the machine.



Temperatures within ideal range: no adjustments required.



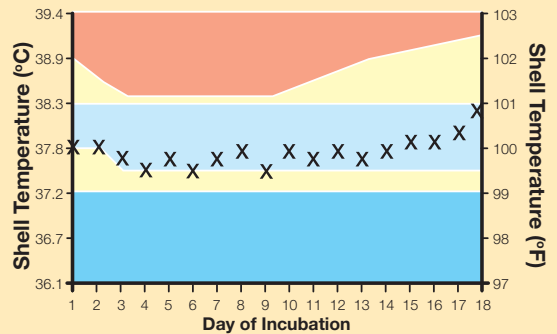
Temperatures from day 14 onwards too high: lower incubator temperature to bring day 14-18 temperatures into ideal range.



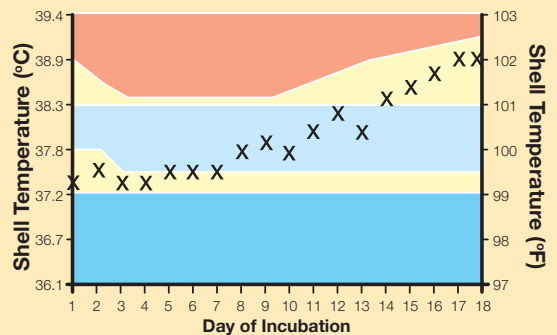
Temperatures from day 8-10 too low: increase incubator temperature to bring day 8-10 temperatures into ideal range.

MULTI-STAGE MACHINES

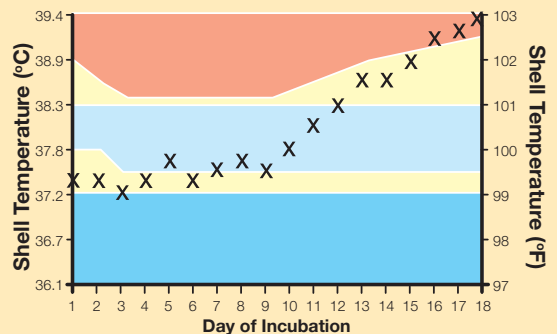
Note: Prior to any alteration of setter operating temperatures, ensure that there are no maintenance problems with the machine and multi-stage loading of the setter is correct.



Temperatures within ideal range: no adjustments required.



Temperatures at the start of incubation in low risk area and at the end of incubation within the high risk area: no adjustment.



Temperatures from day 16 onward in danger range: lower incubator temperature to bring day 16 onward temperatures into risk range.