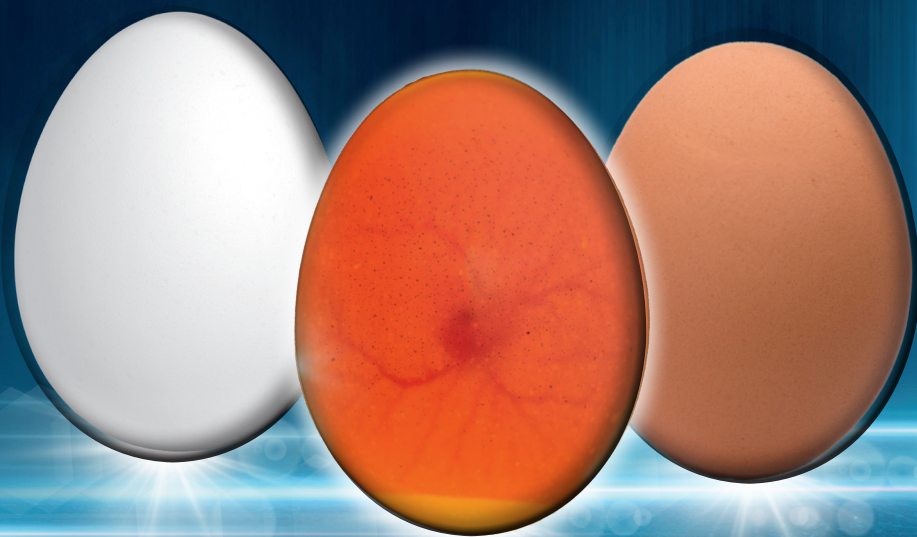


INCUBATION



INTERNATIONAL

The key to your profit!



Management
Guide
SHORT EDITION



The key to your profit

Why should you study this management guide?



This guide aims to provide to new producers a prime and basic understanding about the processes that are necessary to have optimal hatchability and chicks' quality by giving practice proven management recommendations.

When applying them to the individual hatchery the local conditions like equipment, weather, legislation etc. must be taken into account. In addition, recommendations from the machine manufacturer should always be considered.

If you have any questions after reading this guide, we would like to encourage you to contact us.

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HATCHING EGG HANDLING

Embryos need to express their potential during incubation and in later life as pullets and laying hens, good hatching egg quality is crucial.

The hatching egg quality is mainly influenced by these factors:

- Condition and health status of the parent stock flock
- Age of the parent stock flock
- Medication
- Feed quality
- Water quality
- Type of housing
- Climate
- Percentage and quality of males
- Type and cleanness of nest boxes
- House temperature
- Collecting of the hatching eggs

The freshly laid egg has the temperature of the hen's body (41 °C). When cooling down to house temperature causes a contraction of the egg contents leading to air entering the egg which creates the air cell. To minimize the number of germs penetrating the eggshell during this critical time, it is very important that eggs are laid in clean nests.

Therefore, floor eggs are not good hatching eggs. It is very likely that they have already been contaminated by feces, before they can be collected, cleaned, and disinfected.

Good quality eggs for the hatchery should match the following criteria:

- Clean eggshell (No manure, litter, feathers or blood)
- No cracks
- Well-shaped
- No double yolk
- Weight range according to hatchery policy (usually 52 – 68 grams and some hatcheries go as low as 48 g)
- Set with the pointed end downwards

Optimal egg storage condition

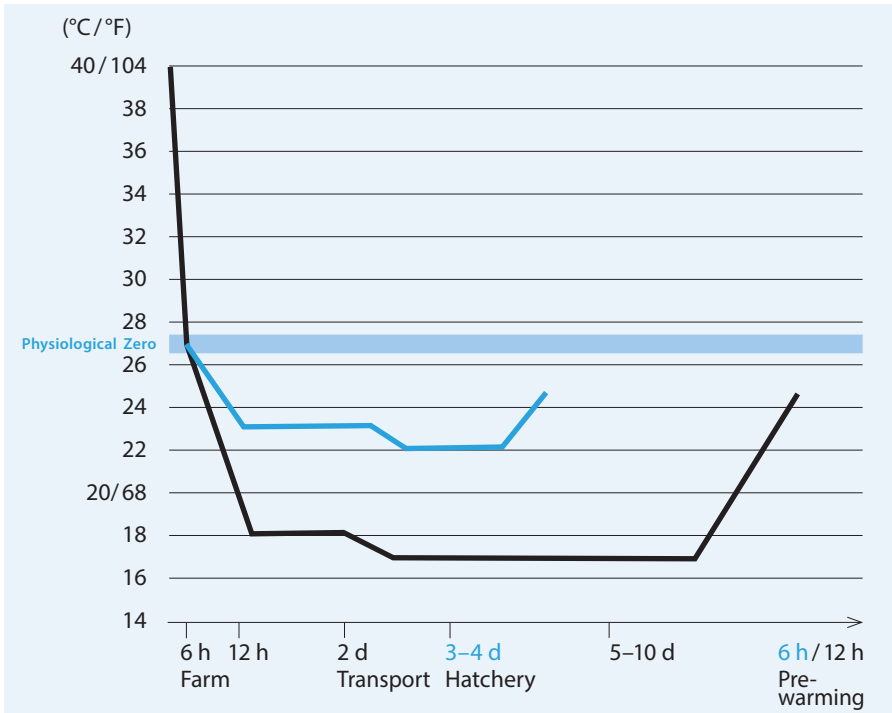
Temperature during storage must be between 16–18°C with a relative humidity of 50–60 %

The above temperature must be reached no later than 6 hours after the egg has been laid. Condensation on the eggs should be avoided by any means because it allows microorganisms to multiply on the wet surface, penetrate the shell and contaminate the egg. It happens when cold stored eggs are brought to a warm environment – for example the

setter room – and the egg temperature is lower than the dew point of the surrounding air. One can roughly say that the temperature increase should not be more than 11°C in situations with little air movement. As soon as there is considerable air flow over the eggs the risk for egg sweating is minimized.

It is best to set eggs having a period of storage between 2 to 10 days. When eggs are stored for longer period hatchability and chick quality are greatly impacted.

Optimal development of the egg temperature from the moment of lay until setting depending on the storage length



Disinfection of hatching eggs

Hatching eggs can be disinfected after collection (prior to storage) or at the hatchery (either after egg traying or before egg setting).

A widely used disinfectant for fumigation is formaldehyde. However, there are modern chemicals available based on glutaraldehyde and different quaternary ammonia com-

pounds, on stabilized hydrogen peroxide and peracetic acid or just H_2O_2 that have the same effectiveness.

Before choosing any chemical please make sure that it is labelled for the use in hatching eggs and follow the recommended mode of application.

Do the basics right

1. Hatching eggs are living organisms. Handle them with care!
2. Grade eggs at the farm. Do not send dirty eggs to the hatchery. Floor eggs are no hatching eggs.
3. Do not try to "clean" eggs by using sandpaper or an iron sponge. This will destroy the cuticle and ease the entrance of microorganism.
4. Check temperature at the farm, during transport and in the hatchery. Aim for a steady decline and stable temperature. There should be no ups and downs. Check not only air temperature, but also egg temperature with an infrared thermometer.
5. Eggs intended to be placed on paper trays and palettes need to be cooled down before. Place them soon after arrival to the hatchery on setter trays. This facilitates a more even temperature.
6. To achieve an even temperature, allow a good air flow in the storage rooms. Don't store the eggs directly on the floor, next to the wall or too tight together. Mind direct sunlight entering the room. No water should drop on the eggs from air-conditioner or humidifier units.
7. Avoid using formaldehyde for disinfecting hatching eggs.
8. Especially after long transport to the hatchery, the eggs need to have a 24 hours rest before setting.



INCUBATION OF HATCHING EGGS

Single-stage vs. Multi-stage incubation

Single-stage

- All eggs within an incubator are set together.
- All eggs are in the same embryonic stage.
- Temperature, humidity, and ventilation set-points follow the needs of the embryo,
- Better hatchability and chick quality than multistage setters
- Improved biosecurity due to be an all-in all-out system and can be easily cleaned, disinfected, and maintained after each batch of eggs.

Multi-stage

- It is usually filled with eggs of six different embryonic ages.
- Incubation environment cannot be optimum for every egg.
- Temperature, humidity and ventilation are set at a fixed point throughout the whole incubation period.
- One advantage is its simplicity both with respect to the control system and management of incubation.

Setting time and pattern

The setting time is determined by the schedule on hatch day, the source of hatching eggs and the incubation conditions.

In general, the incubation time for pre-warmed eggs is 21 days and 3–6 hours for Brown Nick, Coral and Silver Nick and 9–12 hours for Nick Chick / Super Nick (under optimal incubation conditions).

Extra time should be given depending on:

- Egg storage time (1 hour per day exceeding 5 days)
- Flock age (3–6 hours for flocks < 30 weeks and > 50 weeks)

The time to pre-warm hatching eggs can be up to 10–12 hours for eggs going into multi-stage machine and 6–10 hours in single-stage setters.

Incubation time can differ depending on the incubation condition in the individual hatchery or flock characteristics. Therefore, it is recommended to control the correct timing regularly (and adjust the setting time if necessary. This will help to maintain a high level of chick quality.

When setters are not full:

- Trolleys should be 'balanced' which enables the air flow to work correctly.
- The top two and bottom two trays can be left empty of eggs but the spaces should be filled with empty trays.
- Another way is to fill with eggs from another flock or another storage time.
- If different batches of eggs are going to be set together, please ask your setter manufacturer for advice. Incorrect filling in multi-stage incubators can create big problems, resulting in poor results.

Temperature

Temperature is the most important incubation parameter. It mainly determines the speed of embryo development, and it must be kept within the optimal range to assure optimal hatchability and chick quality. The usual practice to determine the embryo temperature is by measuring the eggshell temperature (EST) with an infrared thermometer.

EST measurement should be taken by suitably trained staff only. The required sample size is 10–15 eggs per trolley and from the middle of a tray (trays from the front, middle and back of the machine). The measurement must be carried out at the "equator" of the egg and not at the top above the air cell. Readings of clear eggs are not relevant for the calculation of the average. One should

aim for an EST of 100°F during the entire incubation period (a range between 99.6 and 100.4°F is acceptable).

EST should be measured every 2 days during the incubation period including the first hours after transfer (until external pipping).

Humidity

Humidity affects the moisture loss of the eggs through the pores of the shell. The rate of water loss is influenced by the eggshell quality, the setter humidity and temperature. Egg weight loss (EWL) is the parameter monitored to evaluate the moisture loss of the eggs during incubation.

EWL: Manual weighing with an electronic scale is used to measure egg weight loss. The usual procedure is to mark and weigh 3–6 sample trays before setting and reweigh (tare one empty tray) them at transfer (18.5 days of incubation). When calculating the percentage do not forget to take into consideration the weight of the empty tray. The same trays can be used for examination of embryo mortality and to measure chick yield.

The EWL until day 18.5 (transfer) should be 12 % (acceptable range 11–13 %). This will ensure that most of the eggs experience a moisture loss that is high enough to form the air cell necessary for internal pipping without

risking the dehydration of the chicks, chick quality and hatchability.

By rule of thumb the humidity setpoints during incubation should be increased or decreased by 1 °F (wet bulb) or 2 % relative humidity to modify by 0,5 % the weight loss value.

As an initial setpoint, which should be adapted by your own experience, we recommend on average 53 – 55 % relative humidity or 84–85 °F wet bulb reading. Contact your setter provider for technical assistance (important for single stage setters).

Turning

Eggs must be turned every 60 minutes by 45° throughout the setter period. It is beneficial by preventing the embryo from sticking to the shell membrane, good development of the Corio allantoic membrane, promoting the utilization of the albumen and air circulation.

Turning must be monitored at least every 4 hours and it is extremely important during the first 12 days of incubation.

Do the basics right

1. Do not set eggs the day of lay.
2. Pay attention that no egg sweating occurs when moving the eggs in the setter room.
3. Properly pre-warm the eggs, especially, if they are going to be set in a multi-stage incubator.
4. Only set eggs in well cleaned and maintained machines. Check heaters, coolers, humidifiers, turning device and dampers.
5. Check that the trolleys are properly connected to the turning device.
6. If necessary, add empty trolleys with empty trays to fill up the machine completely.
7. Control the incubator temperature and humidity by using a mercury door thermometer or a good electronic device. Calibrate if necessary.
8. Check egg weight loss and eggshell temperature regularly to fine tune the incubation program.
9. Check, if the conditions of the incoming air meet the requirements.



CANDLING AND TRANSFER

Candling

Candling is a method of identifying infertile and early dead embryos. Trays of eggs are passed over a strong light source which clearly shows infertile and early dead embryos (clear eggs). It is recommended to weekly candle a sample of each flock to monitor the status of the breeders.

Candling is usually done between day 9 and 10 or included in the transfer routine.

If clear eggs exceed 20 %, then all eggs should be candled at transfer, all clear eggs must be removed, and hatcher trays refilled with fertile eggs to 95 – 100 %. By doing this improve hatchability.

Candling can be combined with breakout of clear eggs. It is the best method to identify fertility.

Transfer

Eggs are removed from the setter after 18–18.5 days and transferred from setter trays to hatcher baskets and put in separate hatcher cabinets.

When different batches of eggs are set in one incubator, one should separate them during transfer into different hatchers (if machine capacities allow). This will reduce the hatching window and improve chick quality. It is very important during transfer to assure a smooth process, reduce the number of cracked eggs and try to have completely full hatchers.

The temperature in the transfer room should be at least 25 °C / 77 °F and no trolley should be outside of an incubator for more than 30 minutes.

Under normal conditions, approx. 5000 eggs can be transferred in less than ten minutes. Speed is critical to avoid an excessive, uneven cooling of the eggs, which would increase the hatching window.

Transfer should only be done into clean, warm, and dry hatcher baskets and hatcher cabinets.

Do the basics right

1. Clear eggs are not all infertile. You have to open the eggs to differentiate between infertile and very early dead.
2. Candling, removal of clear eggs and refilling of the trays is recommended, if percentage of clear eggs exceeds 20 %.
3. The temperature of the transfer room should be at least 25 °C / 77 °F.
4. Egg candling and transfer should not last longer than 30 minutes per trolley.
5. Only transfer eggs into a clean, dry, disinfected and heated up hatcher.
6. Preferably set only one batch of eggs per hatcher.
7. Hatcher baskets must be clean and dry.
8. Baskets are best warmed inside the hatchers and taken out directly before use.



HATCHER

The hatching cycle

In the hatcher the eggs will stay for three days. During this time the embryo will develop into a chick. After 19 days of incubation, it will penetrate the inner shell membrane and lung respiration will start.

Not all chicks will hatch at the same time. The time range during which 99 % of the chick's hatch is called "hatch window". Even under good conditions it is not easy to be much shorter than 24 hours. The spread is caused by natural variation in egg quality, egg weight and by varying conditions during egg handling and incubation. Hatch windows longer than 36 hours impact on chick quality, because the first hatching chicks will have to wait a long time in the hatcher, before they are pulled, processed, transported, and finally get access to feed and water.

The hatch window can be easily monitored by taking out three hatcher baskets at several times during the hatching cycle and counting the number of chicks that hatched so far. 36 hours before pull there should be a maximum 1 % and 24 hours not more than 25%. Twelve hours before take-off one should aim for approximately 75 % hatched chicks and six hours later for 99 %.

Collecting this information and analyzing it helps to find the correct setting time according to egg and flock age.

Monitoring chick yield

This is a tool to control the incubation success, chick quality and find the optimal setting time for the eggs. It is best done using the trays where egg weight loss has already been monitored. The technique involves counting and then weighing in bulk the Grade-A chicks from a hatcher basket in order to calculate the average chick weight and then the chick yield. Chick yield is the average chick weight divided by the average initial egg weight (fresh egg) multiplied by 100. An ideal target for best chick quality is a chick yield of 66 – 67 %.

If the egg weight loss during incubation has been correct, but the chick yield is lower than 65 %, then incubation duration is too long. It needs to be adjusted by setting eggs later or by pulling chicks earlier. Every 1 % loss in chick yield is equivalent to about four hours extra under optimal condition in the hatcher.

Hatcher operation

It is good for small and medium size hatcheries to open the hatcher one or two times, have a look at the chicks and change the setpoints, if necessary. Beside the number of chicks hatched so far one should pay attention to the behavior. If the conditions are alright, the chicks are quiet and evenly spread in the baskets.

If the chicks are noisy and/or move towards the pulsator (area with high air speed, cool air) and put their beaks out of the basket, the temperature is too high. If they start panting, it is far too high. If they huddle together in a corner of the basket, it is too cold. In that situ-

ation you would later also find many pipped eggs in the baskets at chick take-off.

In case of questions regarding the setting of hatchers, please contact your equipment provider or H&N technical team.

Do the basics right

1. Control the hatcher temperature and humidity by using a mercury door thermometer or a good electronic device.
2. Do not fully rely on electronics! Watch the chicks one or two times during the hatching cycle to judge the conditions. Do not be afraid to open the doors. The chicks should be evenly spread and quiet.
3. Even though the humidity is rising during hatch, the cabinet walls and the floor

should be kept mostly dry. A wet floor in combination with chick fluff is an ideal breeding ground for germs. Avoid too cold cooling water, which causes excessive condensation on the coils.

4. Check the chicks in the morning on hatch day to schedule the sequence of chick pull. If the chicks in general are too dry or too fresh, search for possible mistakes during incubation. If everything was alright, rearrange the setting times.



CHICK PROCESSING

Chick Temperature

The chicks are now hatched and ready to be processed. The chicks tell you by their behavior and noise if they feel good or not. If they do not, the problem should be investigated and solved.

Measuring the rectal temperature of a representative sample of chicks can help to identify weak points in the process and by this contribute to safeguard chick quality. The rectal temperature of a day-old-chick measured by

an infrared ear thermometer should be preferably in a range between 39.5 and 40 °C.

Checking the chick temperature directly after chick pull gives information about the conditions in the hatcher. This can be used to adapt the temperature profile if necessary for the next hatch. It is normal that the chick temperature drops temporarily during sexing and vaccination. After the processing is completed and the chicks stay in boxes in the holding room the body temperature should be back in the optimal range.

Chick Take-off and Sexing

Commercial day-old chicks are either color or feather sexable. If the breed allows for color sexing, it is usually done directly at chick take-off, whereas the gender sorting of the other breeds is done as a second process. For more information, contact H&N international technical team.

To achieve optimal conditions during take-off one should consider the following recommendations.

- There should be a separate chick take-off room to keep the fluff away from chick vaccination.
- From a hygienic point of view taking out the chicks by hand is preferred to the use of a separator.
- Do not pull too many trolleys at once. It is a common finding that chicks overheat when chick trolleys are waiting in an aisle or other holding areas with insufficient air movement.

Day-old-chick Vaccination

Chicks can be vaccinated in the hatchery by injection, spray, or eye drop. Regardless of the route of administration there are three different factors that influence the success of the vaccination:

1. Physical factors: needle damage, chilling, spray particle size among others
2. Contamination
3. Under or over dosage due to poor storage conditions, wrong preparation, suboptimal application among others

Every layer chick is vaccinated by injection against Marek's disease. There are several vaccines from different producers available (check requirements in your country).

Beside the vaccination against Marek's disease, often a spray vaccination against Infectious Bronchitis or other respiratory viruses is done at the hatchery.



CHICK HOLDING AND TRANSPORT

The behavior of the chicks is the best indicator of the climate conditions during chick holding and transport. Under optimal conditions the chicks are mostly quiet, breathing calmly.

In general, an air temperature of 25–27 °C (77–80 °F) between the boxes and a relative humidity of 50–60 % is recommended. However not the room temperature, but the temperature inside of the boxes is crucial for the well-being of the chicks. Usually it should be 33–35 °C (91–95 °F). Therefore, the optimal room temperature differs depending on the air movement in the room, the type of the boxes, the way of stacking and the number of chicks per box. It is a good practice to check the conditions during holding and transport with a data logger and by measuring chick's vent temperature.

Do the basics right

1. Always pay attention to the behavior of the chicks. It is the best indicator for their well-being.
2. Prepare the vaccine in a separate, clean room.
3. Don't allow unfiltered air to enter the vaccine bags or bottles.
4. Keep the vaccination equipment clean throughout the hatch day. Change needles regularly.
5. Temperature of the chick processing and holding room should be approximately 25°C (77°F).



HYGIENE

General hygiene

Personnel should be provided with shower facilities, dirty and clean sides and clean clothing must be provided daily. Visitors should be minimal and must also go through the same process.

In the hatchery itself each section should be kept separate with mats soaked in disinfectant in each doorway and plastic doors will help to reduce problems and keep the air-flow in different rooms separate.

Chick fluff can be a problem to human health and good airflow and a specially designed fluff tunnel will remove fluff which is also a carrier of any disease organisms present in the hatchers.

The hatchery rooms must be kept clean, and this includes all surfaces including ceilings, ledges and tops of machines. Each room and each machine should be cleaned after use.

Develop a good relationship with your veterinary services and be aware of regulations in your own country which might affect the hatchery.

Cleaning

For every hatchery room, procedures for cleaning and disinfection should be written. When describing procedures for cleaning rooms and equipment, keep the following aspects in mind:

- First, all debris such as fluff, blood, eggshells, broken eggs, and dirt needs to be removed. Since organic material inhibits the chemical action of disinfectants, it is very important that all surfaces to be disinfected are free from debris before applying disinfectant.
- Depending on the degree of soiling this is done by:
 1. First dry cleaning with a vacuum or sweeping.
 2. Soaking of the surface with a foam-cleaner. PH of the detergent should be changed periodically (for example 3 weeks alkaline, 1 week acid) to remove potential biofilms and mineral deposits.
 3. Rinsing with water
 4. Allow to dry.
- After the surfaces are clean and dry apply disinfectant. Read the label closely and follow instructions. Factors affecting the efficiency of disinfectants are: contact time, temperature, concentration, pH, nature of soiling and compatibility with detergents.

Do the basics right

1. Make sure staff are trained and understand the importance of good hygiene.
2. Check that incoming eggs are clean.
3. Check that soap/hand disinfectants are available daily and that they are being used.
4. Check that mats are soaked in disinfectant.
5. Physically check for accumulated dust/debris on surfaces at all levels.
6. Physically check that all filters are cleaned regularly.
7. Check that all doors are closed between rooms.
8. Physically check equipment after cleaning.



PROCESS CONDITIONS

| Room | Temperature (°C) | Humidity (RH %) |
|---------------------|---------------------|--------------------|
| Egg storage room | 16–18 | 60–75 |
| Egg processing room | 16–18 | 60–75 |
| Setters room | 24–26 | 40–60 |
| Transfer room | 24–26 | 40–60 |
| Hatchers room | 24–26 | 40–60 |
| Processing room | 24–26 | 50–60 |
| Chick holding room | 25–27 | 50–60 |
| Transport | 25–27 | 50–60 |



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