Optimum broiler development

A practical guide to ensure correct early broiler performance

Cobb®

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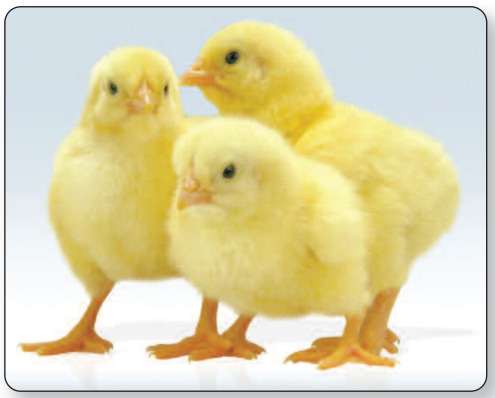
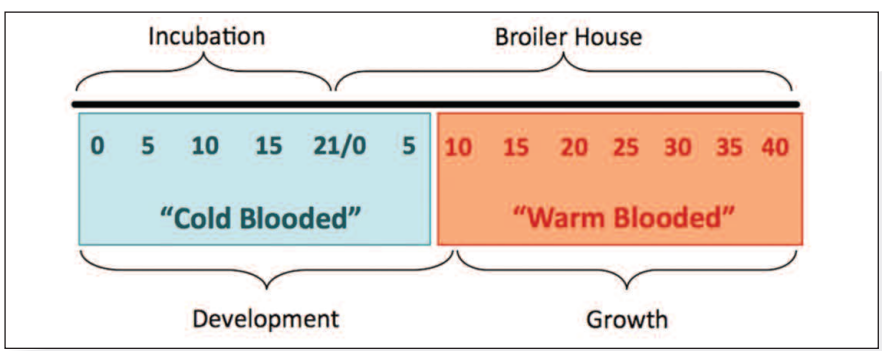
The Optimum Broiler Development Guide is intended as a reference and supplement to your own flock management skills so that you can apply your knowledge and judgment to obtain consistently good results with the Cobb family of products.

Introduction

It is crucial for broiler performance to ensure a proper development of the chick (incubation + first 10 days of grow-out) especially because the chick does not have the ability to properly control its body temperature ('Cold Blooded') during this period.



Winter temperatures pose an additional challenge to the development of chick and the subsequent adult broiler. This is mainly due to poor temperature control and also to compromised ventilation in the broiler houses. Good stockmen have the responsibility to maintain a good environment for the chick to maximize the birds' genetic potential.



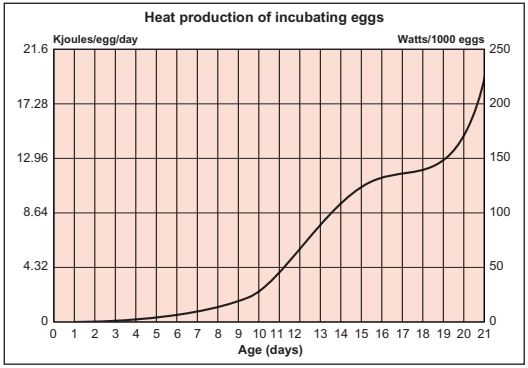
Objectives

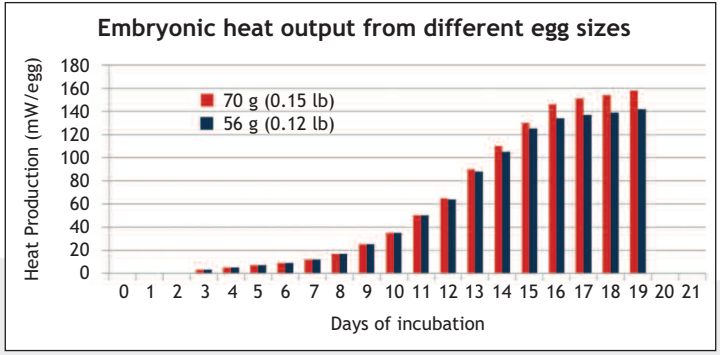
1. Review all the management aspects, in a check list form, that will help maintain broiler performance from the hatchery to the broiler house.

2. Define a few practical measurements that will indicate a successful incubation/brooding and a well developed broiler:
   - Chick quality measurements
   - Chick check
   - 7-day mortalities
   - 7-day weights

1.1. Why focus on incubation?

- Today's meat yield birds can produce higher embryonic temperatures and the risk of embryos overheating is higher. Research trials have shown that adverse incubation conditions can affect performance at different stages of the broiler cycle.
- Hatchery ventilation and incubation temperatures must be able to cope with this or serious damage can be done to the chicks.
- Less active, weaker chicks will show poorer starts and final performance. This will be especially true if brooding/growing conditions are challenging (winter).





Poor chicks

Good chicks

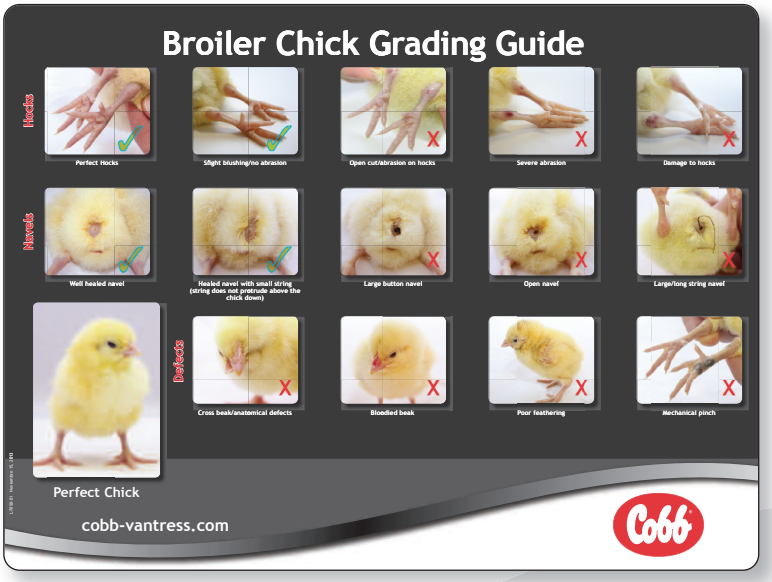
1. Hatchery

1.2. How to establish good chick quality?

- Traditional chick grading standards (right), are done visually and damage done to the chicks from overheating are not obvious to select out by grading operatives.

- Research from Wineland and Hulet indicate that overheated chicks can show the following symptoms:

  - Weakness, tiredness
  - Will be smaller (shorter)
  - Dehydration
  - Smaller hearts, digestive system and less developed immune systems
  - More prone to bacterial infections (E.Coli)
  - More leg problems



1.21. How to establish good chick quality? – Cleanliness of hatch debris

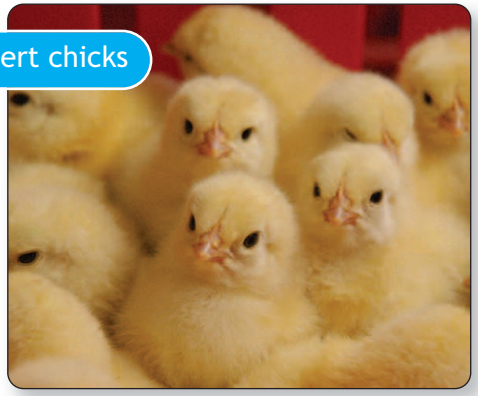
Excess meconium residues on egg shells is a good indication that chicks have hatched too early and stayed too long on the hatcher baskets.

- Another indicator of overheating or chicks being hatched for too long is:
  - leg veins visible/protruding (left).
  - if you crush empty eggshells in your hand, the shell separates completely from the membrane (right).

1. Hatchery

1.22. How to establish good chick quality? - Color and strength

Strong, alert chicks



Weak chicks

- Chicks should be bright yellow. Overheated chicks have poorly absorbed yolk sacs and hence pigments and are whiter than normal. *Caution: Formaldehyde masks white chicks*

- Chicks should stand up and be active. If placed on their backs they should turn themselves within 3 seconds.

1.23. How to establish good chick quality? - Feathering

- Good feather development is synonymous of good chick development during incubation (chicks must look fluffy!).
- However, excess development of the wing feathers does indicate early hatching (overheating) and excessive time in the hatcher baskets.

Well advanced (open), hatched too early

Correct development

1. Hatchery

1.24. How to establish good chick quality? - Colibacillosis control

- This is the most common infectious disease of poultry and is world wide in incidence.
- Infection is via the oral route, via the shell membrane, yolk/navel, water and the incubation period is 3-5 days.

Egg shell contamination and 14 day mortality

Egg condition	Total bacteria	Coliforms	14 day mortality
Clean	600	123	0.9
Soiled	20,000	904	2.3
Dirty	80,000	1,307	4.1

(J. M. Mauldin)

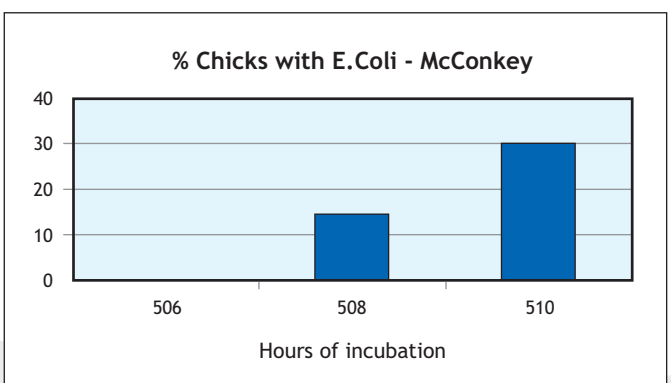
- Poor navel healing, mucosal damage due to viral infections and immunosuppressive challenges are pre-disposing factors to infections.

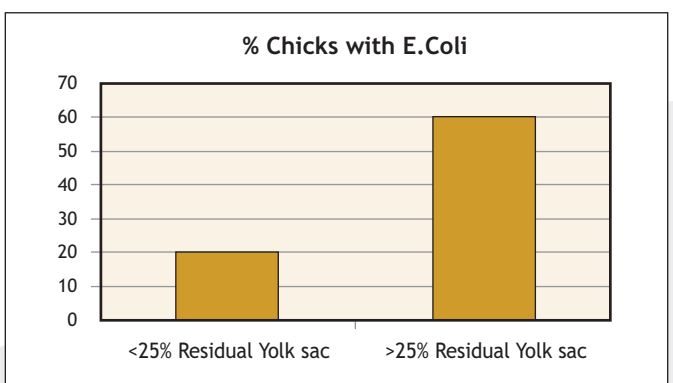
1.24. How to establish good chick quality? - Colibacillosis control

Consequences of overheating embryos
E. Coli susceptibility *(Trial Cobb Spain, 2011)*

It is not clear if overheated embryos are more sensitive because they spend longer in the hatchers (hatch early), but the % of E.Coli isolations seem to increase with:

- Hours of incubation
- Bigger yolk sacs





1. Hatchery

1.24. How to establish good chick quality? - Colibacillosis control

- Treatment is by antibiotic treatment and the type of product used depends on resistance of the bacteria isolated.
- Contaminated hatch debris and chick fluff in the hatchery are major sources of bacterial infection.
- Prevention includes good hygiene of hatching eggs and good hygiene in the hatchery.
- Good hygiene on the farm at depletion is also important because the bacteria are readily killed by disinfection.
- Water hygiene is also potentially important and chlorine at 3 ppm is a good option (water ph dependant (ph <7)).
- Fumigation in the hatchers with formalin has shown good results in reducing bacterial load.

Duration	Solutions	Volume
From transfer to six hours before take off	Formalin can either be applied neat concentrate (36% - 38%) or diluted 1:1 with water (final formalin solution of 18 - 19%)	60 ml of solution per m^3 of hatcher space (2.03 oz per 35 ft^3), in pans with surface area of 50 cm^2/m^3 (7.75 in^2 per 35.3 ft^3). Volumes need to be adjusted for neat concentrate formalin.

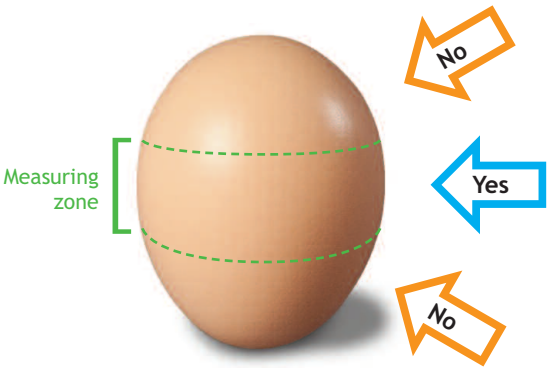
1. Hatchery

1.3. What to measure? – Embryo temperatures

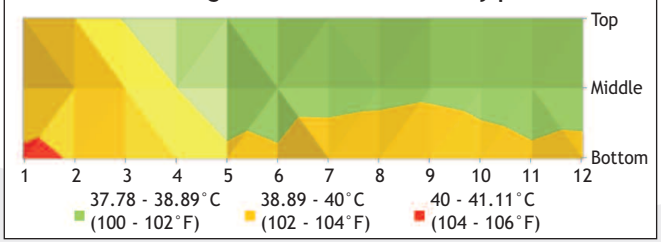
- **Embryo temperatures** - can be measured accurately by taking egg shell temperatures, on fertile eggs at the egg's equator with a thermoscan thermometer between 16 and 18 days of incubation.

  This will highlight how uniform the temperature is inside the incubator and locate any adverse 'hot' or 'cold' spots, as seen in the contour graph below.

  Infertile eggs must not be measured as they have 0.5 -1.7°C (2 - 3°F) lower egg shell temperatures than fertile eggs.



Contour graph showing variance of egg shell temperatures in a multi-stage incubator between tray positions

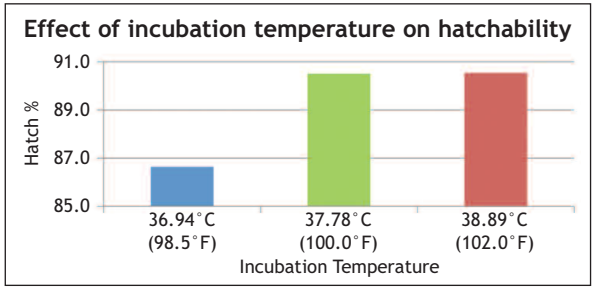


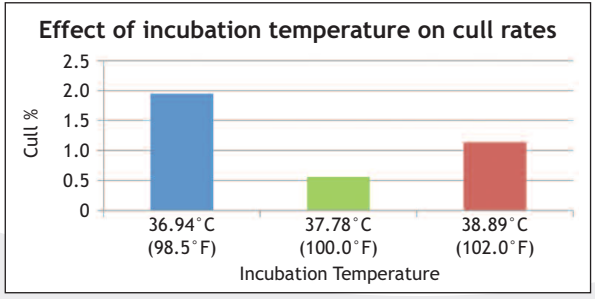
Embryo Temp	Qualification	Consequences
36.7 - 37.7°C (98.1 - 99.9°F)	Too cold	Slow hatch
37.8 - 38.1°C (100.0 - 100.6°F)	Optimum	Good hatch and chick quality
38.1 - 39.2°C (100.6 - 102.6°F)	Too warm	Good hatch, poorer chick quality
39.2 - 40.0°C (102.6 - 104.0°F)	Too hot	Poor hatch and chick quality

1. Hatchery

1.3. What to measure? – Embryo temperatures

- Effect of incubation temperature on hatchability and chick quality can be seen in the graphs below.





Factors affecting uniformity of incubation temperatures:

a. Incorrect ventilation – air volume supply, pressures, damper settings, exhaust ventilation, etc.

b. Temperature calibrations

c. Cooling problems – water flow rates, valves stuck open, water temperature (too hold/cold), scale in pipes, etc.

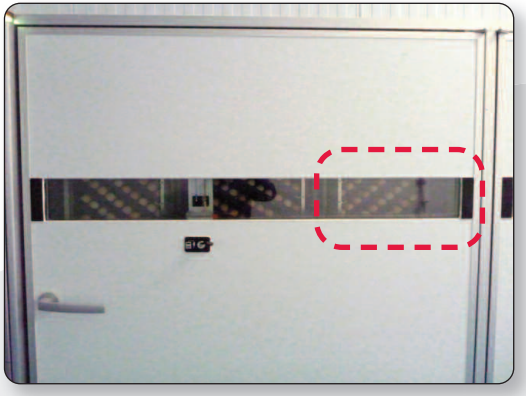
d. Over/under utilization of setting capacities

e. Physics of air movement/design by manufacturer

f. Incorrect setting patterns

g. Maintenance – poor door seals

h. Maintenance - correct turning angle

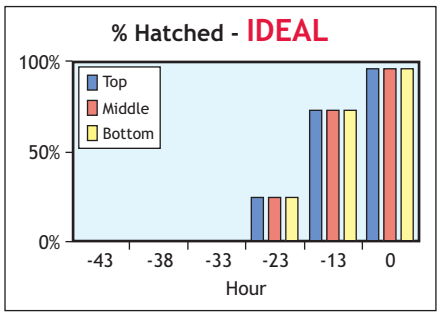


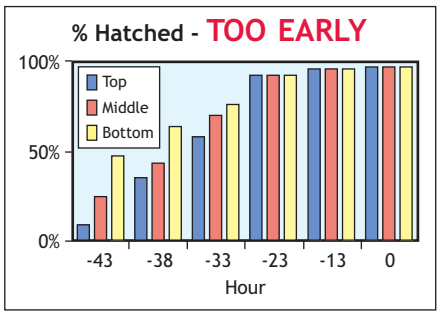
1.31. What to measure? - Hatch window

Hatch Window

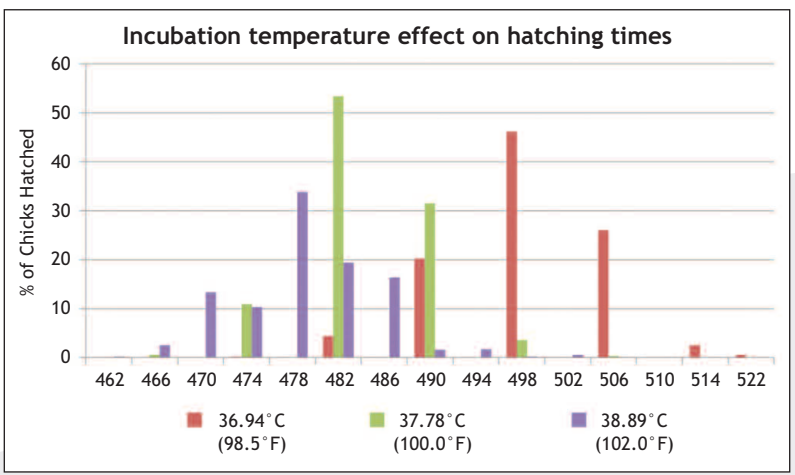
Targets are for the chicks to hatch:
Max. 25%, 24 hours prior to pull
Max. 75%, 12 hours prior to pull

These targets are more critical for chicks being transported over long distances or time delays from hatch to delivery.





The graph shows the influence of incubation temperatures on hatching times (hatch window). The higher temperatures result in early hatching chicks and vice versa for lower incubation temperatures.



1. Hatchery

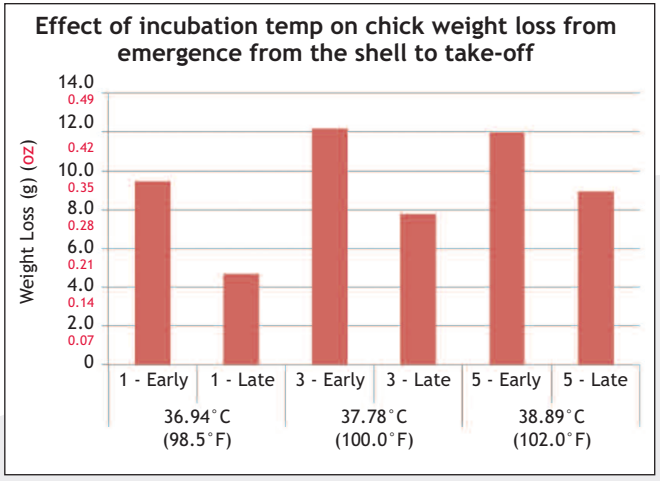
1.31. What to measure? - Hatch window

The Hatch Window can influence -

- chick weight
- residual yolk %
- chick length

Chick weight is the most important criteria from this list as high embryo temperatures cause early hatching, more risk of dehydration and subsequently a correlation to higher early broiler mortality.

Incubation temp.	Hatching times	Chick wt (g/oz) at hatching from shell	Chick wt (g/oz) at take-off	Weight loss (g/oz)	Weight loss %
36.94°C (98.5°F)	1 - Early	44.01/1.55	39.85/1.41	4.16/0.15	9.45
	1 - Late	44.55/1.57	42.47/1.50	2.08/0.07	4.67
37.78°C (100.0°F)	3 - Early	42.06/1.48	36.94/1.30	5.12/0.18	12.17
	3 - Late	44.22/1.56	40.78/1.44	3.44/0.12	7.78
38.89°C (102.0°F)	5 - Early	43.46/1.53	38.25/1.35	5.21/0.18	11.99
	5 - Late	44.22/1.56	40.26/1.42	3.96/0.14	8.95

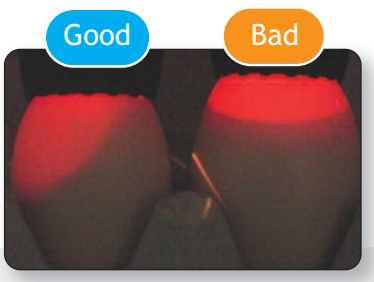


1.32. What to measure? - Chick yield %

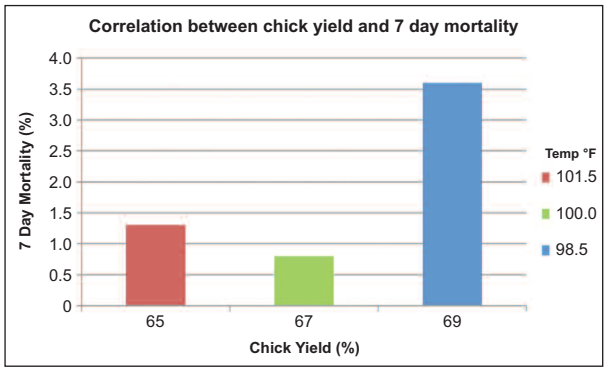
Chick yield is expressed as chick weight as a percentage of the initial egg weight. The old rule of thumb was that chicks weighed approximately two thirds of egg weight or 67%.

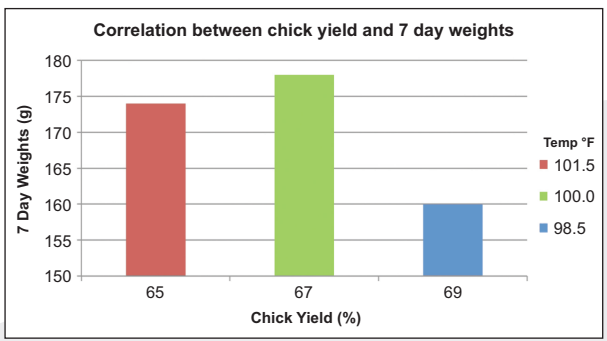
With many incubators today, especially single stage machine, the damper is closed in the early days to aid uniformity of temperature and development of the chorioallantoic membranes. This restriction of ventilation can affect the moisture weight loss of the egg and impact this chick yield %.

Research trials have shown that chick yield % can correlate to broiler 7 day mortality and bodyweights, especially in anti-biotic free environments. Excess moisture/fluid accumulation can be more susceptible to bacterial infection, especially with any stress factors to the day-old chicks.



Picture showing moisture weight loss at 18 days of incubation





Ideal chick yield % should be 66 - 68%

1. Hatchery

1.33. What to measure? - Cloaca temperatures

- Chick internal temperature should be maintained at 40.0 - 40.6°C (104 - 105.08°F). The temperature should be measured gently inside the cloaca.
- Chicks lose 3 g (0.007 lb) of moisture from the feathers which act as a cooling mechanism.
- Chick internal rectal temperature can be measured at take-off or in the chick holding room, but only when the chicks are dry and internal body temperature is stabilized i.e. not directly after spray vaccination.
- Chick internal temperature above 41°C (105.8°F) will lead to panting.
- Chick internal temperature below 40.0°C (104°F) is too cold.

1.34. What to measure? - Chick Quality Assessment

Characteristic	A Excellent	B Acceptable	C Cull

Need to assess chick quality at take-off for the following parameters and score on as an ‘A’, ‘B’ or ‘C’ rating.

Top quality = A chick

Both A and B are saleable chicks

C chicks should be culled

To score a ‘A’ - all the criteria measurements must be in this category

A ‘B’ chick has only A and B ratings

Any score of C = cull chick

Scoring should be done before grading and % based on A and B chicks

1.34. What to measure? - Chick Quality Assessment

Characteristic	A Excellent	B Acceptable	C Cull
1. Reflex	Chick can flip over within 3 seconds	Chick flips back over between 4-10 seconds	Over 10 seconds or fails to flip over

1.34. What to measure? - Chick Quality Assessment

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2. Navel	Clean and well healed	Closed but slight	Not closed/string/button
		abrasiveness	attached or discolored
			

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3. Legs	Clean, waxy legs	Some dryness/pale	Dehydrated with vein protruding
			

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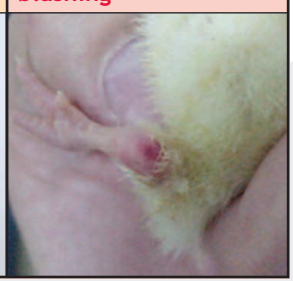
2. Navel	Clean and well healed	Closed but slight abrasiveness	Not closed/string/button attached or discolored
3. Legs	Clean, waxy legs	Some dryness/pale	Dehydrated with vein protruding
4. Hocks	**Clean, no blemishes**	**Slight blushing**	**Red color/heavy blushing**
			

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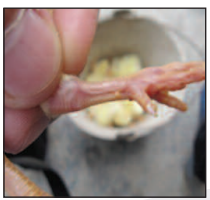
3. Legs	Clean, waxy legs	Some dryness/pale	Dehydrated with vein
			protruding
4. Hocks	Clean, no blemishes	Slight blushing	Red color/heavy
			blushing
5. Defects	**Clean, no blemishes**	**Slight blushing**	**Missing eye/blind**
			legs with cuts/abrasions
			spraddled legs
			cross beaks
			poor feathering
			clubbed down

1.34. What to measure? - Chick Quality Assessment

Hatchery:	Date:	Flock:	Flock Age:

Egg weight at setting	
Egg weight at transfer	
Setter tray weight	
Nett weight loss - setter	
Chick weight	
Chick yield %	

Chick	Reflex	Navel	Legs	Hocks	Defects	Score
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
Total						

	A	B	C
Navels			
Legs			
Hocks			

Rectal Temps: Take-Off _____

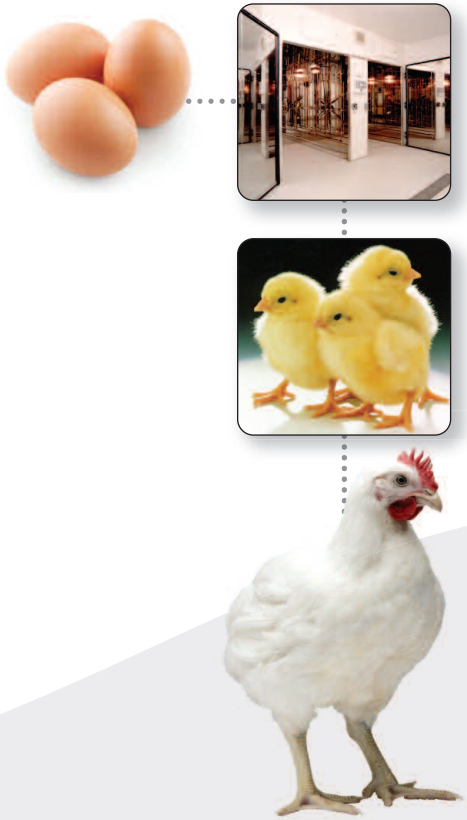
Chick Holding _____

1. Hatchery

1.4. Summary

Below is a table summarizing the effect of incubation temperature on different parameters.

Criteria	Low Temp	Ideal Temp	High Temp
Hatchability	very bad	very good	good
Hatch window	very bad	very good	bad
Cull rates	very bad	very good	good
Chick yield %	very bad	very good	bad
Early mortality (up to 21 days)	very bad	very good	good
Late mortality (more than 21 days)	very good	very good	very bad
FCR	good	very good	very bad
Carcass/breast meat yield	very bad	very good	good
Navel quality	very bad	very good	bad/good
Heart size	very good	very good	very bad
Broiler weight (up to 21 days)	very bad	very good	good
Broiler weight (over 21 days)	very good	very good	very bad
Leg culls	very good	very good	bad
Colibacillosis	bad	very good	very bad



2. Chick transport

2.1. Chick holding

- Ideally room temperatures should be maintained between 24 - 26°C (75.2 - 78.8°F) and RH 65%.
- Pre-warm chick holding room up to temperature before take-off starts to prevent cold stress on chicks, especially in winter.
- Ceiling paddle fans/punka fans should direct air towards the ceiling and not down on chicks to cause chill effects.
- Blue lights or lower light intensity will reduce stress.
- Stocking density in chick boxes minimum 21 cm^2 (3.255 in^2) per chick.

2. Chick transport

2. Chick transport

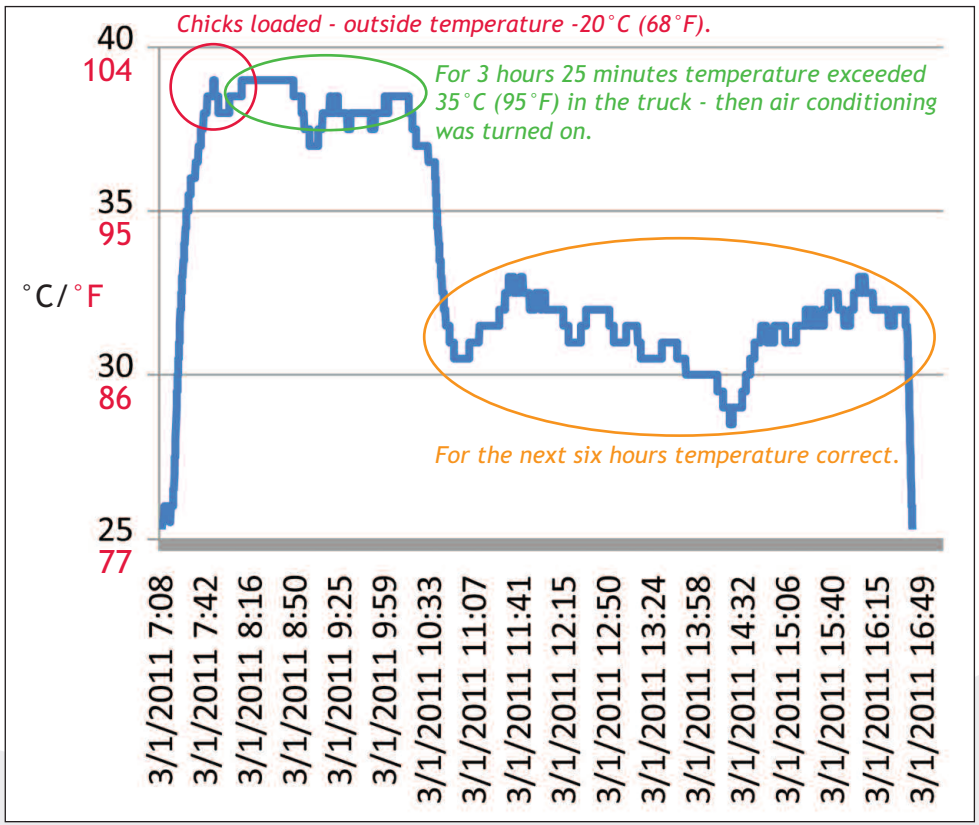
2.1. Chick holding

- Temperatures in plastic boxes should be maintained at 32°C (89.6°F) for the chicks.
- Avoid any drafts or cold stress while loading the vehicle at the hatchery.
- The vehicle cargo hold should maintain a stable temperature of 25°C (+/- 1°C) (77°F [+/-1.8°F]) from hatchery to farm.

- On arrival, face the vehicle into the prevailing wind to prevent wind chill on the chicks during unloading.
- Only unload trolleys of chicks to meet the pace of the staff. Do not have trolleys of chicks waiting on the concrete pad outside the house.

2. Chick transport

2.1. Chick holding



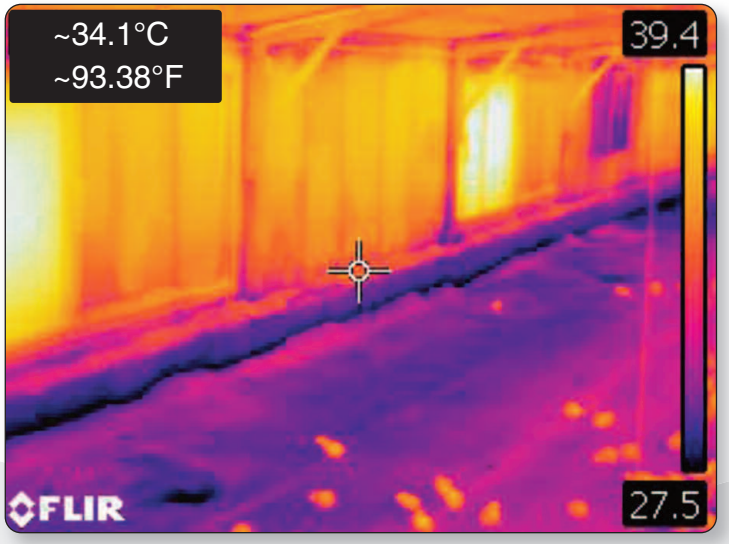
The graph shows excessive temperature in chick boxes during transport where box temperature exceeded 35°C (95°F) for over three hours - seven day mortality of this flock was 1.55% mainly because of culling of small chicks.

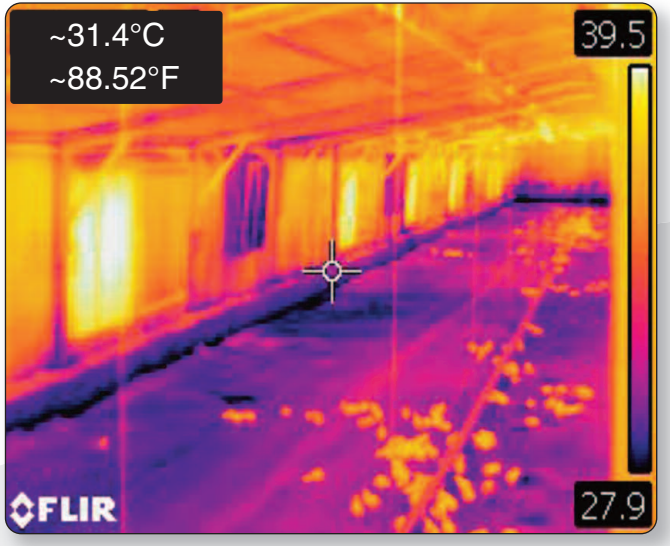
2. Chick transport

3.1. Ventilation

- You cannot properly ventilate or control temperature if the house is not sealed (has air leaks). Test the effectiveness of how well the house is sealed by closing all the inlets, then open a door slightly ajar or crack open an inlet with one fan with a capacity 18 CMH/sq m of floor area (CFM/ft^2) running → should record a pressure in excess of 37.5 pascals (.151 inches of water) at the inlet. If < 25 pascals (.10 inches of water), it indicates that the house is poorly sealed.

- Use plastic sheeting on outside and inside of doors to seal.





3. Brooding

3.1. Ventilation

- There must be no drafts (either warm/cold) at floor level for the first fourteen days of age at least - during this period a draft is any air movement that exceeds 0.3 m/sec (59.055 feet/minute) at floor level.

- The table below indicates the parameters of these key areas to maintain good atmospheric conditions.

Air quality guidelines	
Oxygen %	> 19.6%
Carbon Dioxide (CO_2)	< 0.3% / 3000 ppm
Carbon Monoxide	< 10 ppm
Ammonia	< 10 ppm
Inspirable Dust	< 3.4 mg/m^3 (.0001 oz/35.3 ft^3)
Relative Humidity	70%

Minimum ventilation must never be sacrificed.

- Minimum ventilation must be increased if CO_2 levels exceed 3,000 ppm or oxygen levels less than 19.6%.

3. Brooding

3.1. Ventilation

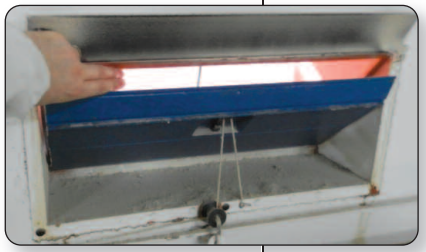
- Minimum ventilation controls air quality via fans which must work on a timer and inlets controlled by pressure and both independent of temperature control. The minimum ventilation system operates any time the house temperature is at or below the house set point temperature.
- The timer should provide a minimum air exchange value of 12.5% (1/8) of house volume. The minimum run time needs to be at least 60 seconds to ensure that the incoming cold, outside air has properly mixed and heated with the internal air before reaching chick level.
- Inlets are vital in achieving good air volume and uniform air distribution.
- The inlets should completely seal when closed.
- The inlets should react to the fans and work on pressure, NOT on percentage of opening or temperature.
- The inlet capacity should match the fan capacity at the fans working pressure based on the width of the house.

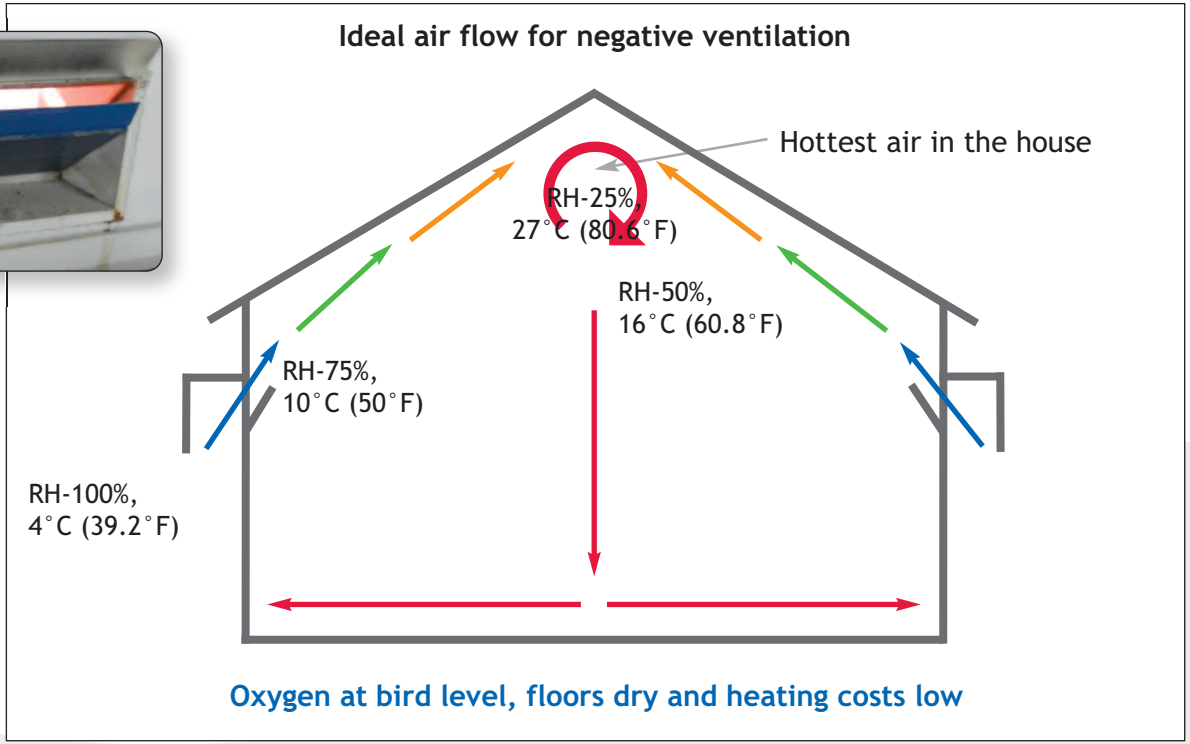
- Automatic calculation of minimum ventilation requirements for your house can be made on our website www.cobb-vantress.com

3. Brooding

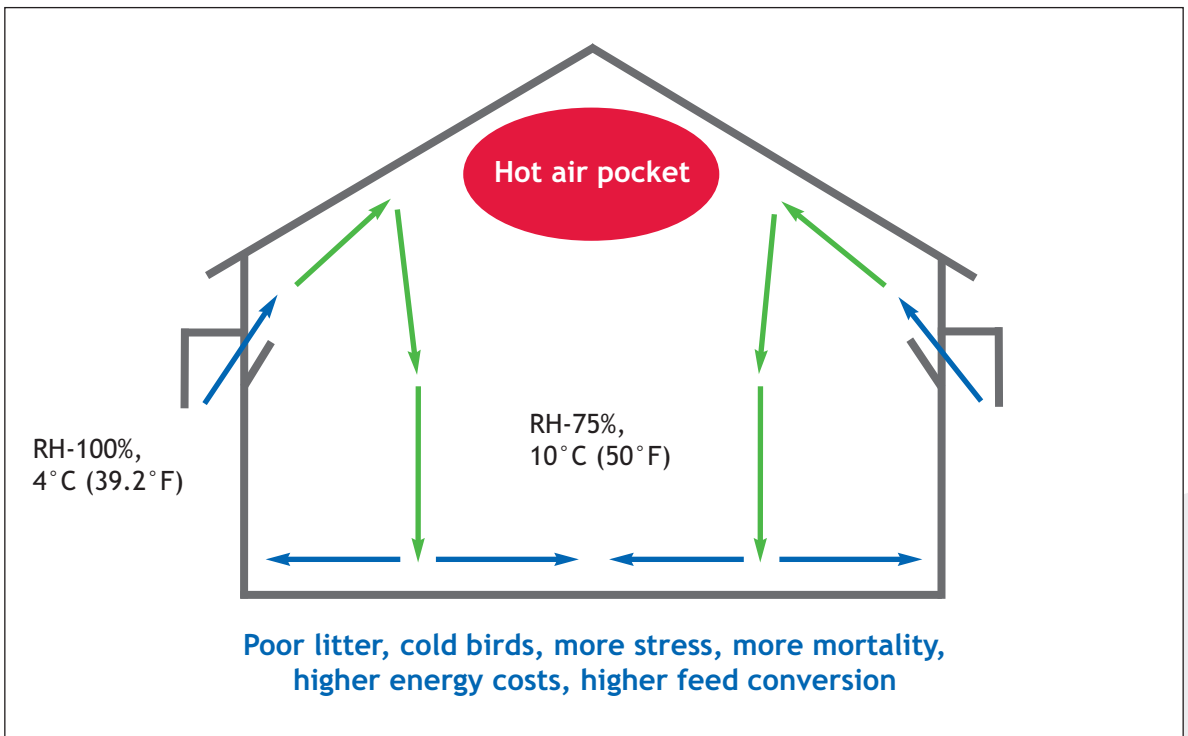
3.1. Ventilation

- The inlet needs to open at least 5 cm (2 inches) to ensure good air mixing in the house.





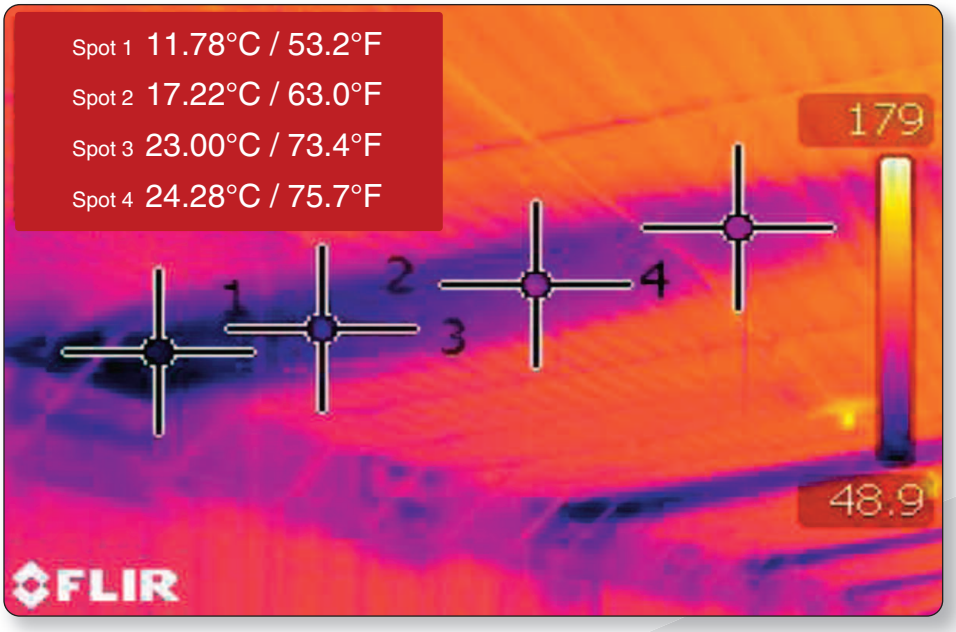
3.1. Ventilation



3. Brooding

3.1. Ventilation

- Air temperature increases as the air travels close to the ceiling.



3.1. Ventilation

Pressure scale complete

- Calculations done at 1.2 kg per cubic meter of air density.

House width - meters (feet)	Pascal's (inches of water)	Air speed m/second (feet/minute)	Distance travel before air drop - meters (feet)
10 (32.81)	8 (0.03)	3.50 (688.98)	5.00 (16.40)
12 (39.37)	10 (0.04)	4.00 (787.40)	6.00 (19.69)
15 (49.21)	17 (0.07)	5.00 (984.25)	7.50 (24.61)
18 (59.06)	26 (0.10)	6.35 (1250.00)	9.00 (29.53)
21 (68.90)	37 (0.15)	7.50 (1476.38)	10.50 (34.45)
24 (78.74)	42 (0.17)	8.00 (1574.80)	12.00 (39.37)

3. Brooding

3.2. Relative humidity

Controlling relative humidity

- The main aim of controlling relative humidity is maintaining dry friable litter.
- Wet or capped litter will lead to increased carcass issues such as podo-dermatitis and hock burn and in extreme situations even breast blisters.
- Carcass downgrades is also used as a measurement of bird welfare. Failure to meet minimum requirements will lead to reduced stocking density that is permitted.
- Moisture is produced by the heating system, drinking system and the birds.
- To control relative humidity the only option is to increase the air temperature - approximately for every 1°C (1.8°F) we heat the air the relative humidity of the air is reduced by 5%.

- Warm air is lighter than cold air and the warmest air in the building is closest to the ceiling.
- The longer we can keep the outside cold air close to the ceiling the better the opportunity of increasing the temperature of that air and therefore reducing its relative humidity.
- The lower the relative humidity of the air at any temperature the larger the potential of that air to carry (soak up) moisture from the environment.
- 70 - 75% of the water consumed by the bird will be excreted to the air or the litter. It is the job of the ventilation system to remove and prevent a moisture build up in the house.

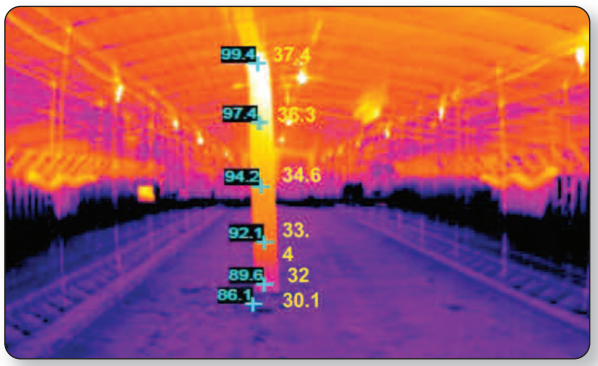
3. Brooding

3.2. Relative humidity

How to keep floors dry

- Reduce relative humidity!
- 1°C (1.8°F) increase in air temperature = 5% RH reduction.
- Heated air expands and holds more moisture.
- The more we warm the incoming air from its outside temperature the bigger the moisture holding capacity of the air increases.
- The best results from reducing air relative humidity are when there is a big difference between inside and out temperature.
- Better reduction in relative humidity - winter time, during brooding.
- Less effective reduction in relative humidity - summer time, when the birds are older and in warm climates.

The warmest air is closest to the ceiling



Reduction in RH% when air is heated to 30°C (86°F)

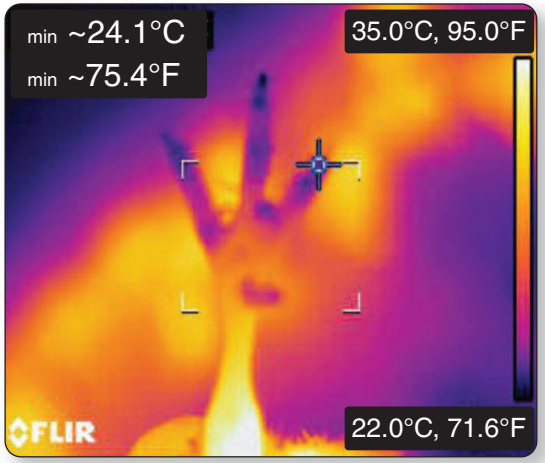
°C (°F)	H_2O - g/m³ / lb/ft³	% RH	New % RH
0°C (32°F)	4.86 / 0.00030	100	15
3°C (37°F)	5.98 / 0.00037	100	19
5°C (41°F)	6.84 / 0.00042	100	22
7°C (45°F)	7.81 / 0.00048	100	25
10°C (50°F)	9.49 / 0.00059	100	30
12°C (54°F)	10.78 / 0.00067	100	34
15°C (59°F)	13.02 / 0.00081	100	41
20°C (68°F)	17.66 / 0.00110	100	56

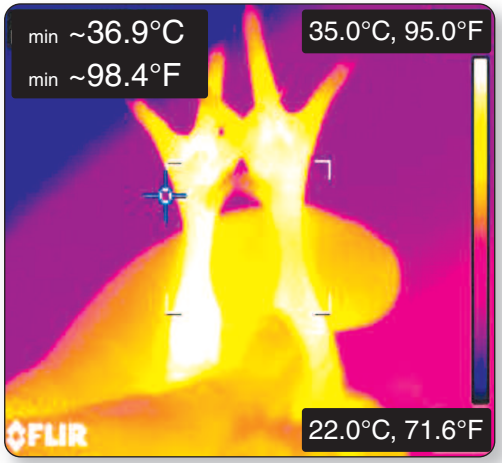
3. Brooding

3.3. Temperature

Cold Chicks

- Floor temperatures are critical for the first two weeks as the chicks tend to lose significant heat through their feet.

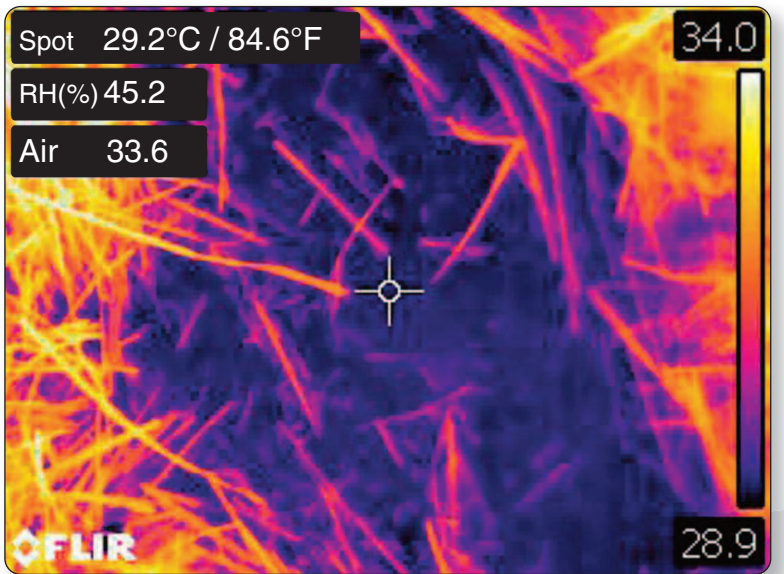




3. Brooding

3.3. Temperature

- Pre-heat house for 48 hours before chicks arrive, with brooding temperatures stabilized for 24 hours before placement to heat the litter and house temperature to 32˚C (89.6˚F) (blow type heaters) and 40.5˚C (104.9˚F) (for radiant heaters - under the brooder) providing a minimum concrete temperature of 28˚C (82.4˚F).

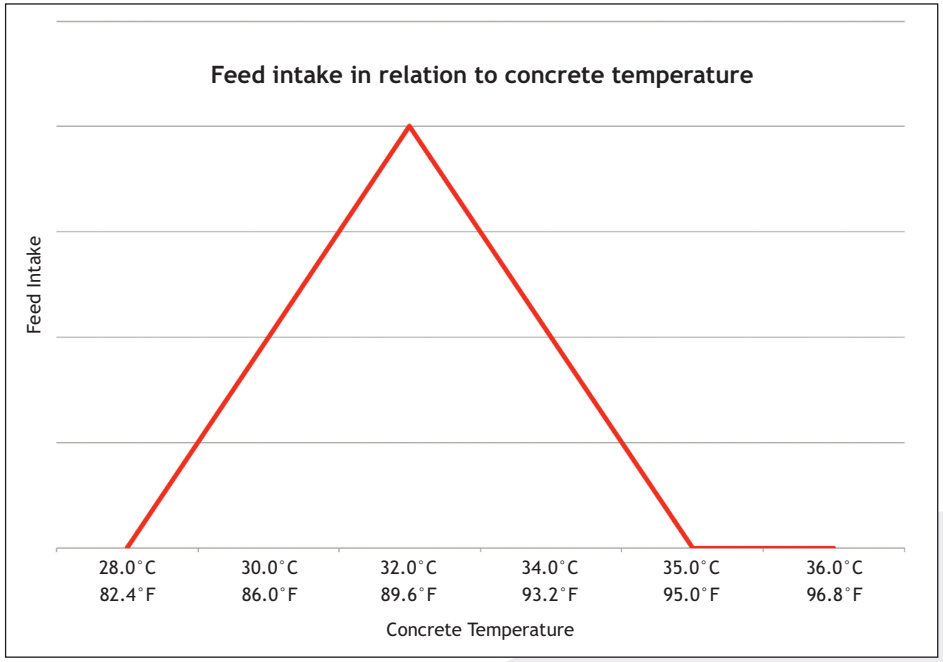


Concrete temp from adequate pre-heating and the minimum ventilation system transporting the warm air uniformly.

3. Brooding

3.3. Temperature

- As concrete temperature increases feed intake follows. The maximum concrete temperature should be 32°C (90°F) as after this temperature feed intake decreases and at 35°C (95°F) stops altogether.



3.3. Temperature

- Often concrete/litter temperature is measured quickly at chick placement in a few random areas and not a true picture is taken of how uniform litter concrete/ litter temperature actually is. The best way to measure is to take a reading (both concrete/litter) every six meters in length of the poultry house and in three rows across the width of the house.

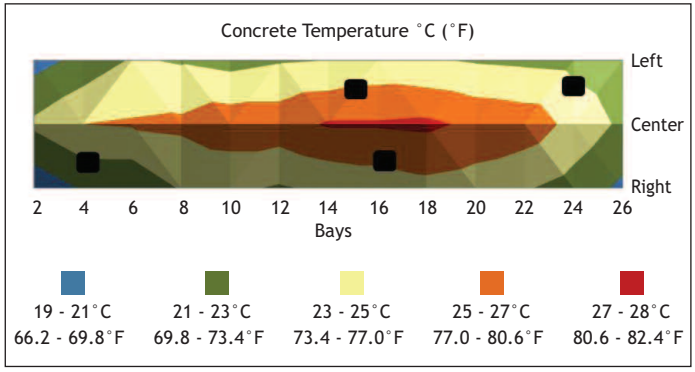
Measure every 6 m (19.69 ft) and in three rows across the house

3. Brooding

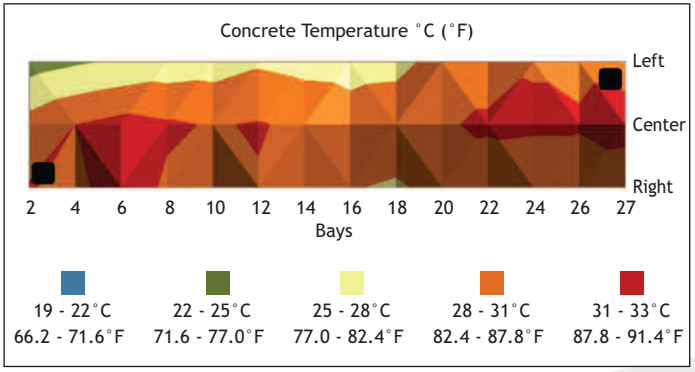
3.3. Temperature

- These readings can then be entered in excel to produce a contour graph.

Poor uniformity of concrete temperature

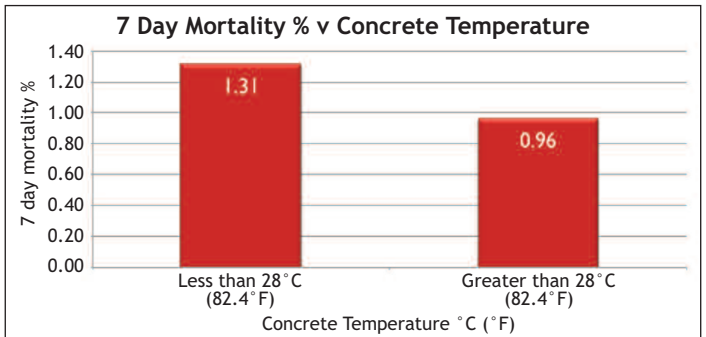


Excellent uniformity of concrete temperature

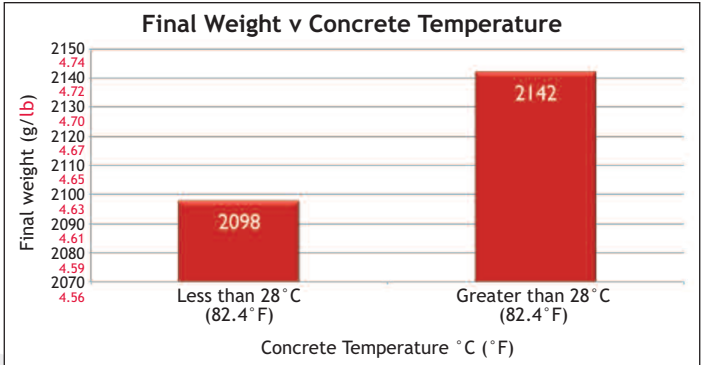


3.3. Temperature

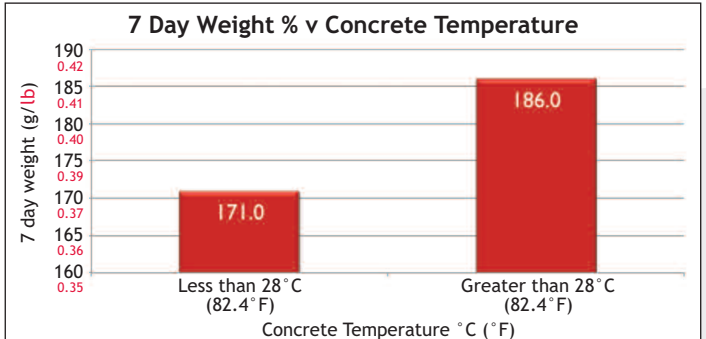
- Concrete temperature has a big impact on early performance especially mortality, weight gain and flock uniformity.
- An acceptable broiler as-hatched flock uniformity has a CV of 8-10 (day old chick average uniformity CV 7.88).



7 day mortality increases to 1.31% from 0.96% when concrete temperature at placement is LESS THAN 28˚C (82.4˚F).



Final weight increases to 2,142 g (4.72 lb) from 2,098 g (4.62 lb) when concrete temperature at placement is GREATER THAN 28˚C (82.4˚F).

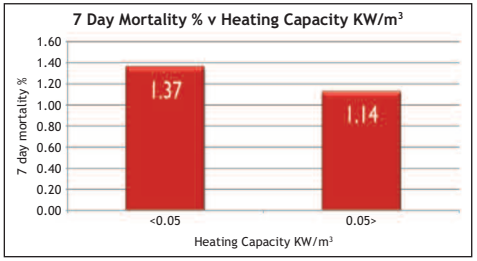


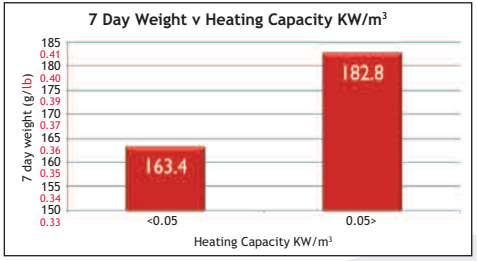
7 day weight increases from 171 g (0.38 lb) to 186 g (0.41 lb) when concrete temperature at placement is GREATER THAN 28˚C (82.4˚F).

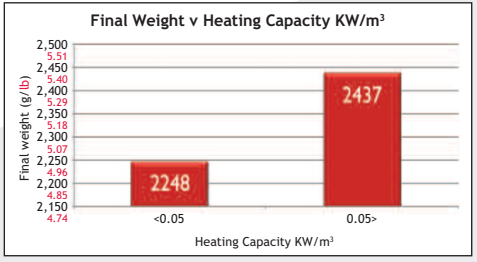
3. Brooding

3.3. Temperature

- The minimum temperature for the first 14 days should not fall more than 1°C (1.8°F) below the set point.
- Ensure heaters have been serviced.
- Calibrate sensors before placement.
- Ensure you have adequate heating capacity.
- Radiant heating - ensure the correct number of chicks per heater.
- Forced air heating - where winter outside minimum temperatures are above 0°C at least 0.07 kw/hour per cubic meter of house volume is required, and where the outside temperature is below zero, 0.10 kw/hour per cubic meter of house volume heating capacity.
- Install back up thermometers to confirm environment.
- Place sensors at bird height.
- Chicks from pre-peak breeder flocks are smaller and have a higher need for external heat to maintain their optimal body temperature compared to larger chicks. Smaller chicks have increased surface to body weight ratio and therefore body heat loss is greater than larger chicks.







3.3. Temperature

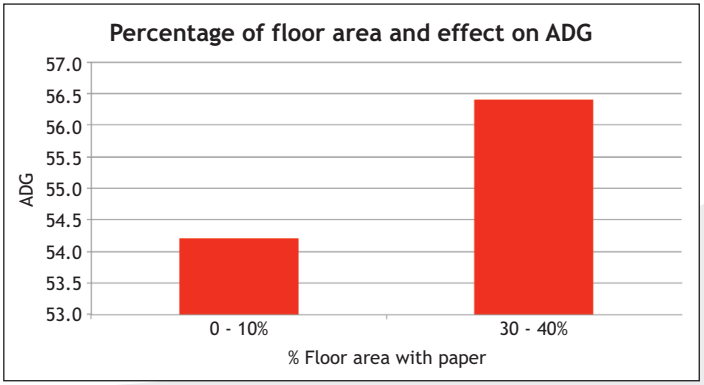
Temperature guide

Age days	Relative humidity %	Temperature °C (°F) (for chicks from 30 week old parent flocks or younger)	Temperature °C (°F) (for chicks from 30 week old parent flocks or older)
0	30-50	34 (93.2)	33 (91.4)
7	40-60	31 (87.8)	30 (86.0)
14	40-60	27 (80.6)	27 (80.6)

3. Brooding

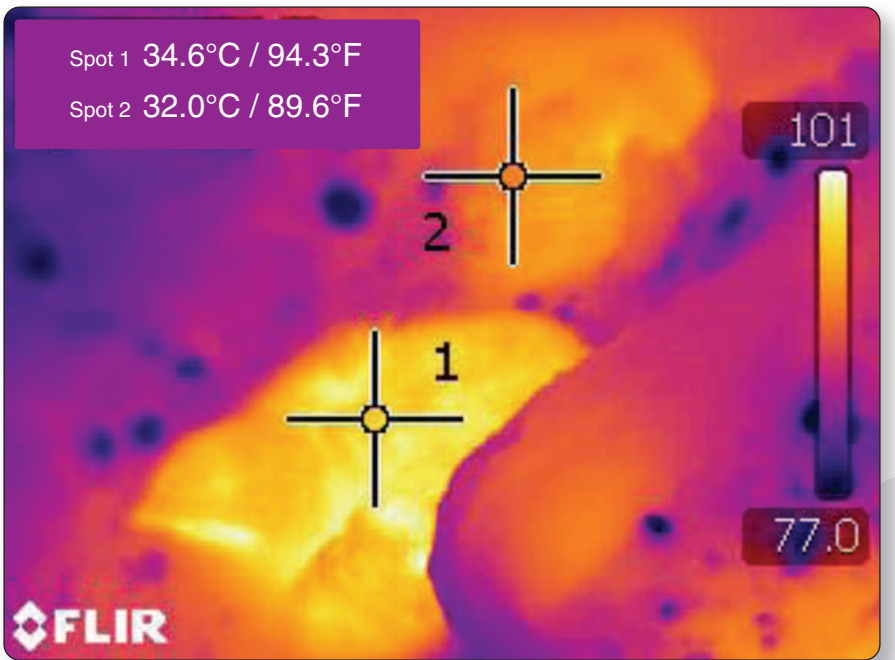
3.4. Feeding

- Feed space using paper covering minimum 50% of the floor area.
- Paper used should be news type paper and not tissue paper to ensure adequate time for feeding before the paper breaks down.
- Feed amount on paper at placement (one application), minimum 70 g (0.15 lb) per chick.
- A line of paper should be placed at each side of each drinker line used in the house.
- The automatic feeding system should be placed on the concrete floor or down in the litter to make access to the feeding system as easy as possible for the chicks.
- The feeding system should be set on overflow/ have pans flooded for chick placement (if possible).
- On each entry to the house during brooding the feed lines should be manually run to stimulate feed intake.



3.4. Feeding

- Effect of feed intake on internal chick temperature - the chick at 34.1˚C (93.38˚F) and the chick at 32˚C (89.6˚F) has not eaten.



3.4. Feeding

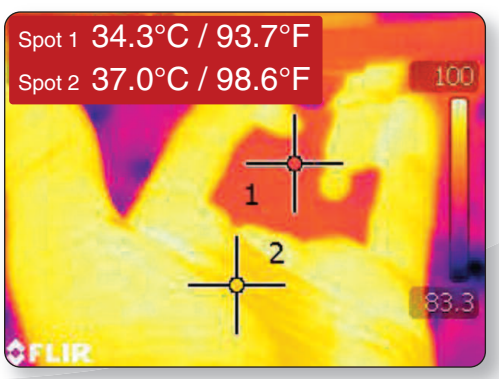
Closed housing - whole house brooding

Curtain housing - partial house brooding

3. Brooding

3.5. Water

- Water spillage and wastage should be kept to a minimum especially in winter time because of lower air exchange during these months.
- Ideally at placement a bead of water should be visible on the end of the nipple to encourage water consumption-this is achieved by setting the pressure low in the drinking system. After the first hours and once you are sure that water consumption has been adequately achieved in the flock, turn the pressure setting in the drinking system up to prevent spillage and wet litter.
- Chicks should not be encouraged to drink from the drip trays after the first day of placement - water easily becomes contaminated from the environment and wasted onto the litter.
- Water consumption of 1 ml/bird (3.4 oz/100 chicks) per hour for the first twenty four hours after placement - minimum.
- Maintain litter moisture between 25-35% under the drinking system, reduce pressure if litter becomes damp.
- Place drinker lines at a height that the birds have to stretch slightly to reach.
- Ideal water temperature is between 10-14˚C (50-57˚F), however birds can tolerate a wide range of water temperature; even so water temperature should never be allowed to be less than 5˚C (41˚F) or greater than 25˚C (77˚F). If this occurs the drinking system must be flushed.



Water temperature at placement (34.3˚C/ 93.7˚F).

3. Brooding

3.51. Water - Flow rate

- Also we need to have sufficient flow rate from the nipple to aid water intake and therefore feed intake in the first week.
- In fact chicks consume nearly three times the volume of water as feed during this period.
- At day old a chick can apply a pressure of 3 g (0.007 lb) to the nipple so they can only activate the nipple from the side, at 9 - 10 days of age a chick can apply a pressure of 7 - 10 g (0.015 - 0.022 lb) so they can activate the nipple from the bottom.

Week 1	**40 ml (1.35 oz)/min**
Week 2	**50 ml (1.69 oz)/min**
Week 3	**60 ml (2.03 oz)/min**
Week 4	**70 ml (2.37 oz)/min**
Week 5	**90 ml (3.04 oz)/min**

3.6. Lighting

- Light intensity - at least 25 lux (2.32 foot candles) in the darkest place at floor level.
- Light intensity should not vary by more than 20% from brightest to darkest place at floor level.
- Fluorescent lights should be installed at a minimum of one watt/m^2 (10.76 ft^2) of floor area.

3. Brooding

3.7. Chick check

The main objective of management during the first hours after placement on the farm is to achieve as much intake of both feed and water in as many chicks as possible.

Failure to achieve this objective will lead to irreversible compromised flock performance and will express itself as poor growth, poor feed conversion and poor flock uniformity.

- An excellent indicator of floor temperature is the temperature of the chick's feet.
- If the chick's feet are cold, the internal body temperature of the chick is also reduced.
- Cold chicks will be seen huddling with reduced activity and resulting in reduced feed and water intake and therefore reduced growth rate.
- By placing the feet against your neck or cheek one can readily learn how warm or cold the chick is.
- If they are comfortably warm, the chicks should be evenly and actively moving around the brooding area.
- If the crops of the chicks are checked eight hours after placement a minimum of 85% of examined chicks should have both feed and water present.
- A minimum of 95% of the bird's crops should be filled upon examination the morning after placement.
- Sample 100 chicks per brood area.
- Check: temperature of feet against neck or cheek.
- If the feet are cold, re-evaluate pre-heating temperature.
- Evaluate crop fill and indicate results on form as below:

Crop fill	No. of chicks	Full - Pliable *Feed & water*	Full - Hard *Only feed*	Full - Soft *Only water*	Empty
Evaluation					

4. Ultimate performance indicators

4.1. 7-day mortality/weights

- Mortality percentage is a good indicator of chick quality, hatching process, house set up and early brooding management.
- **Maximum seven day mortality should not exceed 1% cumulative.**
- Measuring seven-day weights will give an indication of how successful the brooding management has been.
- Failure to achieve good seven-day weights will mean an inferior result at the end of the growing cycle.
- **For every gram at day 7 we should target an increase to 11.8 g (0.03 lb) at 35 days.**
- The objective is to achieve 4.4 times the day old weight at seven days of age-minimum.

Age days	Weight for Age (g)	Weight for Age (lb)	Daily Gain (g)	Daily Gain (lb)	Average Daily Gain (g)	Average Daily Gain (lb)
0	42	0.093	0	0.000		
1	56	0.123	14	0.031		
2	72	0.159	16	0.035		
3	89	0.196	17	0.037		
4	109	0.240	20	0.044		
5	131	0.288	22	0.048		
6	157	0.346	26	0.058		
7	**185**	**0.408**	**28**	**0.062**	**26.4**	**0.058**
8	215	0.474	30	0.066	26.9	0.059
9	247	0.545	32	0.071	27.4	0.061
10	283	0.624	36	0.079	28.3	0.062
11	321	0.708	38	0.084	29.2	0.064
12	364	0.803	43	0.095	30.3	0.067
13	412	0.908	48	0.106	31.7	0.070
14	**465**	**1.025**	**53**	**0.117**	**33.2**	**0.073**
15	524	1.155	59	0.130	34.9	0.077
16	586	1.292	62	0.137	36.6	0.081
17	651	1.435	65	0.143	38.3	0.084
18	719	1.585	68	0.150	39.9	0.088
19	790	1.742	71	0.157	41.6	0.092
20	865	1.907	75	0.165	43.3	0.095
21	**943**	**2.079**	**78**	**0.172**	**44.9**	**0.099**
22	1023	2.254	80	0.175	46.4	0.102
23	1104	2.432	81	0.179	47.8	0.106
24	1186	2.613	82	0.181	49.3	0.109
25	1269	2.796	83	0.183	50.8	0.112
26	1353	2.981	84	0.185	52.1	0.115
27	1438	3.171	85	0.190	53.6	0.117
28	**1524**	**3.360**	**86**	**0.189**	**54.4**	**0.120**
29	1613	3.557	89	0.197	55.6	0.123
30	1705	3.760	92	0.203	56.8	0.125
31	1799	3.967	94	0.207	58.0	0.128
32	1895	4.178	96	0.212	59.2	0.131
33	1993	4.395	98	0.216	60.4	0.133
34	2092	4.613	99	0.218	61.5	0.136
35	**2191**	**4.831**	**99**	**0.218**	**62.6**	**0.138**

4. Ultimate performance indicators

5. Glossary

5. Glossary

Key Factors	Targets
Carbon dioxide	<3,000 ppm
Chick box temperature	32˚C (89.6˚F)
Chick cloaca temperature	40.4 - 40.6˚C (104.7 - 105.1˚F)
Chick feathers at placement	Closed
Chick vitality	When turned on their backs should stand up in 2-3 seconds
Crop fill - at twenty four hours after placement	95%
Egg shell	Minimum amount of meconium present
Egg shell temperatures	37.8 - 38.1˚C (100 - 100.6˚F)
Embryos hatching too early	Hatch window – max. 25%, 24 hours before pull
Feed area	50% of floor area minimum
Feed on paper	70 g (0.15lb)/chick at placement
Heating capacity	0.07 - 0.1 kW/cubic meter (35.3 ft^3) of house volume
House pressure test	>37.5 Pascal's (.15 inches of water)
Light intensity	25 lux (2.323 foot candles) at floor level
Litter moisture level	<35%
Concrete temperature at placement	28˚C (82.4˚F)
Litter temperature at placement	32˚C (89.6˚F)
Minimum flow rate 1st week	40 ml (1.35 oz)/minute
Minimum inlet opening	5 cm (2.36 inches)
Pre-heating before placement	48 hours
Radiant litter temperature under heater	40.5˚C (104.9˚F)
Seven day weight	4.4 times day old weight
Seven day mortality	<1%
Water consumption for the first twenty four hours	1ml (.034 oz)/chick/hour
Water temperature at placement	10 - 14˚C (50 - 57.2˚F)

5. Glossary

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L-7011-03-EN
November 19, 2015