An Aviagen Brand

BROILER

Pocket Guide

2025

This Pocket Guide

This Pocket Guide was produced to complement the Arbor Acres® Broiler Management Handbook. It should be used as a quick and practical reference for broiler stock management.

Each section contains cross-references to relevant sections of the Arbor Acres Broiler Management Handbook, where further information can be found. This Pocket Guide is not intended to provide definitive information on all aspects of broiler stock management, but to draw attention to important management practices which, if overlooked, may negatively impact flock performance.

Performance

This Pocket Guide summarizes best management practices for broilers kept under good nutritional, management, and health conditions, and are considered to be the most appropriate for achieving good broiler performance (live and through processing), health, and welfare.

However, the information within this Pocket Guide cannot wholly protect against performance variations which may occur for a wide variety of reasons.

For further information on the management of Arbor Acres broiler stock, please contact your local Arbor Acres representative.

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SECTION 1

Introduction

Stockmanship

The importance of stockmanship for broiler welfare, performance, and profitability must not be underestimated.

A good stockman will be able to identify and respond to problems quickly.

Three Essentials of Stockmanship.
(Source: adapted from Animal Welfare Committee [AWC] definition of the "ideal state to strive for").

1

Knowledge of animal husbandry.

Sound knowledge of the biology and husbandry of farm animals, including how their needs may be best provided for in all circumstances.

2

Skills in animal husbandry.

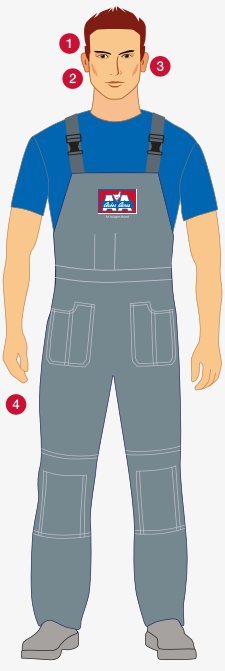
Demonstratable skills in observation, handling, care, and treatment of animals, as well as problem detection and resolution.

3

Personal qualities.

Affinity and empathy with animals, dedication, and patience.

Stockmanship is a continuous process that uses all of the stockman's senses to monitor the flock.



1 Sight

Observe behaviors such as bird distribution in the house and number of birds feeding, drinking, and resting. Observe the environment, such as dust in the air and litter quality. Observe bird health and demeanor, such as posture, alertness, eyes, and gait.

2 Smell

Keep notice of smells in the environment, such as ammonia levels. Is the air stale or stuffy?

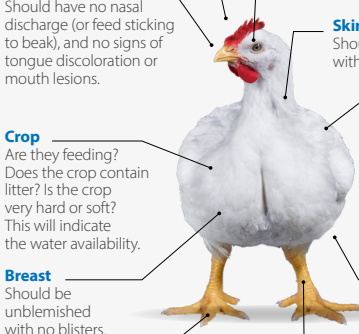
3 Hearing

Listen to the birds' vocalization, breathing and respiratory sounds. Listen to the mechanical sounds of fan bearings and feed augers.

4 Feel

Handle the birds to assess crop fill and check the birds' general condition. Take notice of air movement across your skin. Is there a draft? What does the temperature of the house feel like?

Bird assessment.



Compare this stock sense information with actual farm records — are the birds on target for age? Investigate any irregularities and develop an action plan to address any issues.

BIRD HANDLING

Animal welfare and safety are of utmost importance at all times. It is critical that people handling birds are experienced and trained in the correct techniques that are appropriate for the purpose, age, and sex of the bird.

SECTION 2

Chick Management

Preparation for Chick Arrival

Farm Preparation

Clean and disinfect housing prior to chick arrival.

Houses should be preheated for a minimum of 24 hours prior to chick arrival.

Recommended environmental conditions at placement are:

Air temperature (measured at chick height in the area where feed and water are positioned):

- 30°C (86.0°F) for whole-house brooding.
- 32°C (89.6°F) at edge of brooder for spot brooding.

Floor temperature: 28–30°C (82.4–86.0°F).

Litter temperature: 28–32°C (82.4–89.6°F).

Relative humidity (RH): 60–70%.

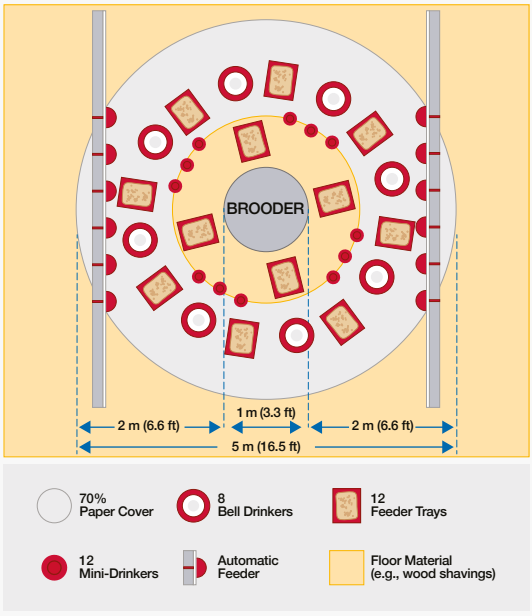
Spread litter material evenly.

Make feed and water available to the chicks immediately.

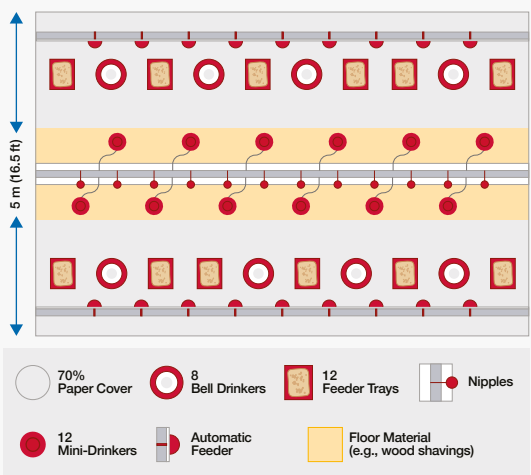
Litter depth under different situations.

Ideal brooding set-up and brooding conditions	Litter Depth
No issue with litter disposal. Temperate climate.	**2–4 cm (0.8–1.6 in).**
Problems with litter disposal. Temperate climate.	**<2 cm (0.8 in).** Below 2 cm (2 in) not recommended: Does not provide adequate insulation from cold house floors. Will have poorer moisture absorption. Will result in increased contact with manure.
No issue with litter disposal. Cold climate.	**>4 cm (1.6 in).** Provides greater insulation against cold floors.

Example of a typical spot brooding layout (1,000 chicks).



Typical layout of a whole-house brooding system (1,000 chicks).



Drinking and Feeding systems

Ensure drinking space is correct for the drinker type used.

The water supplied to the chicks should be approximately 18–21°C (64.4–69.8°F).

Provide feed as a sieved crumble on feeder trays (1 per 100 chicks) and/or on paper (occupying at least 70% of the brooding area).

Recommended drinking space requirements during brooding.

Drinker Type	Drinking Space
Bell	8 drinkers per 1,000 chicks (125 chicks per drinker)
Nipple	10–12 birds per nipple
Mini-drinker or tray	12 mini-drinkers per 1,000 chicks

Effect of water temperature on water intake.

Water Temperature	Water Intake
Less than 5°C (41.0°F)	Too cold, reduced water consumption
18–21°C (64.4–69.8°F)	Ideal
Greater than 30°C (86.0°F)	Too warm, reduced water consumption
Above 44°C (111.2°F)	Birds refuse to drink

Chick Placement

Unload chicks and place them quickly onto paper in the brooding area.

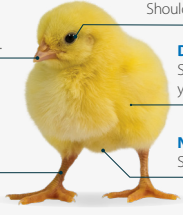
Leave chicks to settle for 1–2 hours with access to feed and water.

Check feed, water, temperature, and humidity after 1–2 hours and adjust where necessary.

Approximately 40 g (1.5 oz) of feed per bird should be placed in flat trays or on paper, and automatic feeding systems flooded with feed.

Chicks from different parent sources should be brooded in separate areas within the house (e.g., parent flocks under 30 weeks of age or day-old weight less than 35 g should not mix with chicks from parent flocks over 40 weeks of age).

Day-old chick quality assessment.



Brooding Management

The First 10 Days

If paper does not disintegrate naturally it should be removed from the house no later than the end of day 4, if chicks are being vaccinated against coccidiosis.

Brooding rings, if used, should gradually be expanded from 3 days of age and removed completely from 7 days of age in closed-sided housing.

These may need to stay in place until 10–12 days of age in open-sided houses.

Top up the feed on the paper or feed trays at regular intervals during the first 3–4 days of age.

Birds should be on the main feeding system by 6–7 days of age.

Gradually change to a good-quality pellet once transfer to the main feeding system is complete after 10 days.

Provide 23 hours of light for the first days after placement to encourage feed and water intake.

Gradually reaching 4–6 hours of dark by 7 days.

MANAGEMENT FUNDAMENTAL

Monitor chick behavior to ensure brooding conditions are correct.

Environment

The table on the next page illustrates the relationship between RH and apparent temperature (the temperature the bird actually feels). If RH is outside the target range, the temperature of the house should be adjusted as indicated and in line with bird behavior.

MANAGEMENT FUNDAMENTAL

Establish a minimum ventilation rate from day one to provide fresh air and remove excess moisture and waste gases, and help maintain temperatures and RH at the correct level. Avoid drafts.

Use chick behavior and chick vent temperatures to determine if environmental conditions are correct.

Using chick behavior along with vent temperatures will give an indication on the actual temperature required.

- Monitor temperature and RH regularly (twice daily in the first 5 days and daily thereafter) and check automatic equipment with manual measurements at chick level.
- Calibrate automatic equipment at least once per flock.

Principles of how optimum dry bulb temperatures for broilers may change at varying RH. Dry bulb temperatures at the ideal RH at a weight less than 200 g (0.44 lb)[+] are colored green.

Body Weight g (lb)	Dry Bulb Temperature °C (°F)			
	40 RH%	50 RH%	60 RH%	70 RH%
44 (0.10)	36.0 (96.8)	33.2 (91.8)	**30.8 (87.4)**	**29.2 (84.6)**
100 (0.22)	33.7 (92.7)	31.2 (88.2)	**28.9 (84.0)**	**27.3 (81.1)**
180 (0.40)	32.5 (90.5)	29.9 (85.8)	**27.7 (81.9)**	**26.0 (78.8)**
290 (0.64)	31.3 (88.3)	28.6 (83.5)	26.7 (80.1)	25.0 (77.0)
425 (0.94)	30.2 (86.4)	27.8 (82.0)	25.7 (78.3)	24.0 (75.2)
590 (1.30)	29.0 (84.2)	26.8 (80.2)	24.8 (76.6)	23.0 (73.4)
790 (1.74)	27.7 (81.9)	25.5 (77.9)	23.6 (74.5)	21.9 (71.4)
1015 (2.24)	26.9 (80.4)	24.7 (76.5)	22.7 (72.9)	21.3 (70.3)
1260 (2.78)	25.7 (78.3)	23.5 (74.3)	21.7 (71.1)	20.2 (68.4)
>1530 (3.37)	24.8 (76.6)	22.7 (72.9)	20.7 (69.3)	19.3 (66.7)

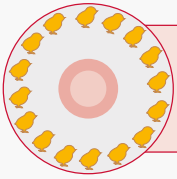
Temperature calculations based on a formula from Dr. Malcolm Mitchell (Scotland's Rural College).

This table provides general guidance; however, individual climatic conditions should be considered.

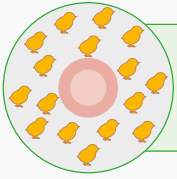
[+]Recent research suggests that RH is less critical for body weights between 200 g (0.44 lb) and 2,500 g (5.51 lb). Further studies are underway to assess RH effects at both lower and higher body weights.

Monitor Chick Behavior

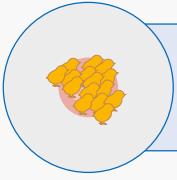
Bird distribution and behavior under brooders.



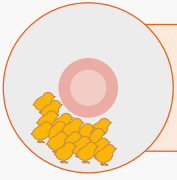
Temperature too high
Chicks make no noise.
Chicks pant, head and wings droop.
Chicks away from brooder.



Temperature correct
Chicks evenly spread.
Noise level signifies contentment.

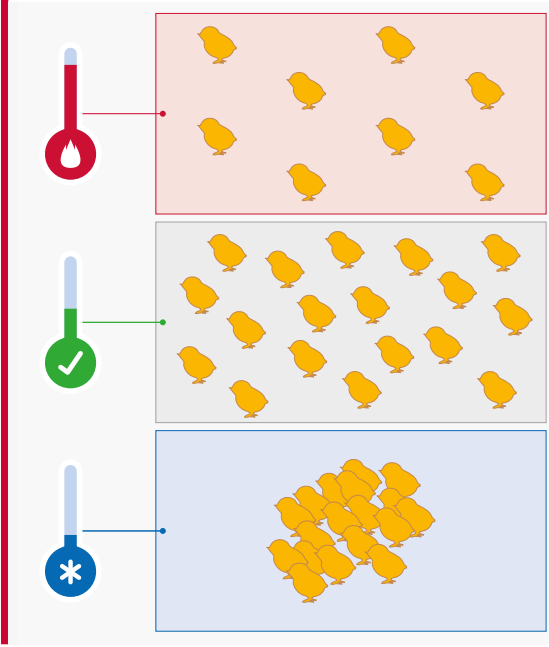


Temperature too low
Chicks crowd to brooder.
Chicks noisy, distress-calling.



Draft
Chicks huddling in one area of the surround.

Typical distribution of chicks in whole-house brooding (without chick surround) at different temperatures.



Chick Start Assessment

Crop Fill

PROCEDURE

Assess Crop Fill

1. **Collect 30–40 chicks at 3–4 different places in the house (or surrounding area where spot brooding is used).**

2. **Gently feel the crop of each chick:**

   Full, soft, and rounded – chicks have found feed and water.

   Full but hard, with original feed and texture felt – chicks have found feed but little or no water.

Crop fill after 24 hours. The chick on the top has a full, rounded crop, while the chick on the bottom has an empty crop.

Target crop fill assessment.

Time of Crop Fill After Placement	Minimum Crop Fill (% of chicks with full crop)
2 hours	75
4 hours	80
8 hours	>80
12 hours	>85
24 hours	>95

Early crop fill in the first 2–4 hours is crucial. The sooner chicks get to 100% crop fill, the better the chick start.

MANAGEMENT FUNDAMENTAL

Crop fill should be assessed and monitored during the first 48 hours, but achieving the correct crop fill in the first 24 hours is most critical.

If target levels of crop fill are not being achieved then something is preventing the chicks from feeding and drinking, and action must be taken.

Chick Vent Temperature

PROCEDURE

Measuring Chick Vent Temperature

1. **Collect at least 10 chicks from at least 5 different locations of the house for the first 2 days after placement.**
2. **Gently pick up the chick and hold it so that the vent is exposed.**
3. **Place the tip of the ThermoScan® thermometer onto the bare skin and record the temperature.**

Note: Do not take the vent temperature of chicks with wet or dirty vents. Pay attention to cold or hot areas of the house (e.g., walls or under brooders).

The ideal chick body temperature for the first 2 days after hatching is 39.4–40.5°C (103–105°F).

SECTION 3

Monitoring live weight and uniformity of performance

Manual Weighing

Collecting individual chick weights at day-old and 7 days is good practice.

When weighing birds manually, birds should be weighed regularly and at the same time of day.

On each occasion, similar-sized samples of birds should be taken from at least 3 locations in each house or pen.

CV% as a tool for assessing brooding management.

Difference in CV% between day 0 and day 7	Chick start assessment
0%	Excellent
+1%	Very Good
+2%	Good
+3%	Average
+4%	Poor
+5%	Very Poor

Bulk Bird Weighing

Between 0 and 21 days, birds can be weighed in bulk.

A minimum of 100 birds (or 1% of the population, whichever is larger) should be weighed each time.

PROCEDURE

Bulk Bird Weighing

1. **Suspend the scales with a bucket or weighing vessel attached above the pen in a secure place and set it to "zero."**
2. **Sample birds from at least 3 evenly distributed locations throughout each house. Sampling points should be away from doors and walls.**
3. **Calmly and correctly handle birds, count, and place them into the weighing vessel until it has the desired number of birds in it (do not overcrowd).**
4. **Place the weighing vessel back onto the scales, wait until it is still, and record the bulk weight from the scale and bird count before releasing the birds back into the main house area.**
5. **Repeat this process until ALL birds in the catching pen have been weighed (this will eliminate any selective bias).**
6. **When all sample birds in the house have been weighed, add all recorded weights together and divide by the total number of birds weighed to give the average bird weight for that house.**
7. **Plot average weights on a weight chart.**

PROCEDURE
Individual Bird Weighing
1. Scales should be suspended above the pen in a secure place and set to "zero" with a 'shackle' in place for holding the birds firmly during the weighing process.
2. A minimum of 100 birds (or 1% of the population, whichever is larger) should be weighed each time.
3. ALL birds in the catching pen must be weighed to eliminate selective bias.
4. Once all sample birds have been weighed in the house, calculate average live-weight and CV% for each house.
5. Plot average weights and CV% on a weight chart.

Automatic Weighing Systems

Readings from any auto-weigher should be regularly checked for usage rate (number of completed weights per day) and the mean live weights achieved should be cross-checked by manual weighing at least once per week.

Weight bandwidth should be set (e.g., ±20% of average weight) to avoid multiple birds standing on the scale simultaneously.

Inaccurate live weight estimation will result from small sample sizes (e.g., older and heavier males use auto-weighers less frequently).

Check weigher location.

Inconsistent Weight Data

If a sample weighing produces data that are inconsistent with the previous weights or expected gains, a second sample of birds should be weighed immediately. This will confirm whether or not there is a problem and identify potential issues (e.g., improper sampling procedures, feed change, drinker failures, temperature fluctuation, or disease) needing to be resolved.

Flock Uniformity

The coefficient of variation % (CV%) or uniformity% describes the variability of a population (the flock).

Profiling a flock's uniformity%/CV% is essential to good broiler management.

Investigations into flocks or farms with poorer-than-expected uniformity levels and variable weight-gain records are essential to prevent processing and economic loss.

Areas to consider for investigation first are:

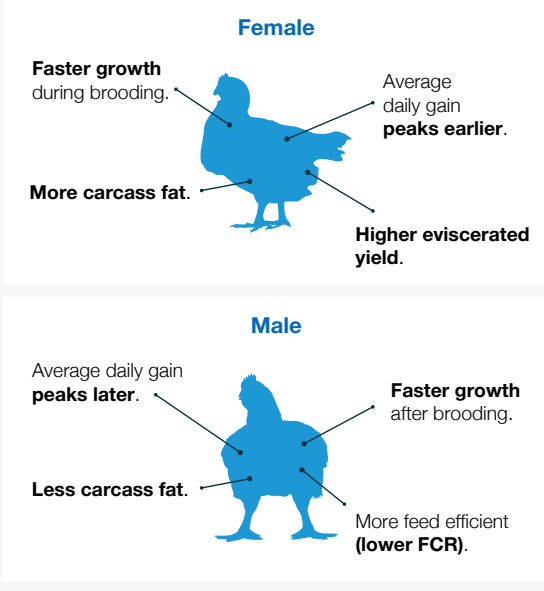
- Chick quality.
- Brooding management.
- Feeder and drinker management.
- Feed quality (physical and nutritional composition).
- Stocking densities.
- Ventilation/environmental management.

Separate-Sex Growing

Improvements in uniformity can be attained by growing flocks in single-sex populations from placement.

The most practical method is to use the same feeds for both sexes but to introduce the finisher feed earlier for females (e.g., before 25 days of age).

Distinct characteristics in female and male broilers.



SECTION 4

Pre-Processing Management

Preparation for Catching

Allow 3 days on 23 hours light and 1 hour dark (where permitted by local legislation) at a minimum of 5–10 lux (0.5–0.9 foot candles) prior to catching.

It is recommended that feed is removed from the birds 8–12 hours before processing (always adhere to local laws and regulations).

Feed Withdrawal Period =

- **Time in House Without Feed**
- +
- **Catching Time**
- +
- **Transport Time**
- +
- **Holding (Lairage) Time**

Insufficient or excessive feed withdrawal periods.

Insufficient feed withdrawal period	Excessive feed withdrawal period
False estimates of live weight.	Unnecessary additional weight loss.
Increase the risk of fecal contamination.	Reduce yield.
	Meat quality issues.

Monitor and review feed withdrawal plans regularly.
Remove whole grain from the ration 2 days before processing.
Delay the removal of drinkers until catching time.
Follow statutory withdrawal periods for pharmaceutical products.

Pre-Catch

Prior to catching, the following checks should be made.

Checklist before catching.

Pre-Catch Check	Action	Yes/ No?
Time taken to catch and transport birds	Is the time taken to catch and transport birds calculated correctly?	
Number of crates/ modules	Is the number of crates/modules and trucks required to transport the birds calculated before catching?	
Equipment	Is all equipment used (including vehicles, crates, fencing, and nets) clean, disinfected, and in good condition?	

Checklist before catching *(Continued)*.

Pre-Catch Check	Action	Yes/ No?
Condition of the ground at the house entrance	Is there a smooth exit for the loaded trucks?	
	If not, is the ground at the entrance to the poultry house (and any secondary roads leading to the house) repaired, compacted, and leveled?	
Litter	Is wet litter replaced for ease of catching?	
Feeding equipment	Is feeding equipment removed from the house or repositioned to avoid obstruction for the birds and personnel (i.e., raising feeding equipment above head height)?	
Penning	Are partitions available for large houses to separate birds?	

Checklist before catching *(Continued)*.

Pre-Catch Check	Action	Yes/ No?
Light intensity	Is there a sudden increase in light intensity?	
	Is it nighttime catching?	
	Is the light intensity reduced to the lowest possible level that will allow the birds to be caught safely?	
	Are headlamps or blue light used to keep birds calm?	
	If daytime catching, are curtains (or another material) used over the doors to reduce light intensity?	
Ventilation	Is there any heat buildup within the house?	
	Is there sufficient air movement over the birds?	
	Are there birds showing signs of overheating (panting)?	
	Have heaters been turned off?	

Catch

Correct way to catch/hold a broiler.

Plan carefully and supervise catching closely.
Catching should be carried out by competent and trained personnel only.
Reduce light intensity prior to catching.
Place birds carefully into the crates or modules, loading from the top down.
The number of birds per transport crate or module is subject to local legislation. In high temperatures reduce bird numbers.
Mechanical catching must follow the manufacturer's instructions.
During catching, the main house doors should remain closed to maintain adequate negative pressure and ventilation.
Monitor birds closely for signs of overheating.

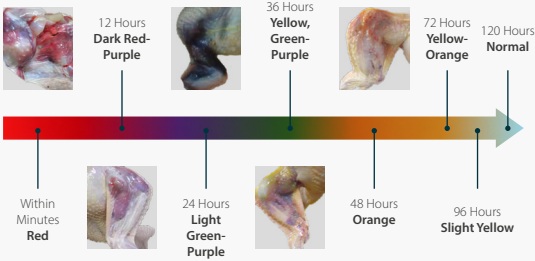
Remove or raise obstructions such as feeders or drinkers before beginning the catching operation.

Minimize bird activity during catching to avoid injuries and optimize product quality.

Use partitions in large houses to avoid crowding.

Analyzing bruising is a useful way of establishing where problems have occurred and if additional training is required.

Changes in bruising color with time.



Thinning/Partial Depletion

- Withdraw feed several hours in advance (always adhere to local laws and regulations) while keeping water available until the point of catching.
- Time without feed for the remaining birds must be kept to a minimum to avoid flightiness.
- House temperature and ventilation must be maintained for the remaining birds.

Transport

- Local transportation laws and regulations must be followed.
- Vehicles must provide adequate protection from the weather and maintain appropriate ventilation.
- Ventilation and/or extra heating should be used when necessary:
  - During loading.
  - When the vehicle is stationary.
  - At the holding area at the processing plant.
- Birds should not remain on the vehicle for any longer than necessary.

SECTION 5

Provision of Feed and Water

Feeding Program

Feeding Program

Feed	Age Fed	Comments
Starter	**0–10 days** but can be fed for up to 14 days if target weights are not achieved.	A good quality starter feed will support early growth and physiological development, ensuring target weights, good health and welfare are achieved.* Starter formulations should be based primarily on promoting good biological performance and profitability, not feed costs.
Grower	**11–24 days**	The transition from starter to grower feed involves a change in texture and nutrient density and needs to be managed carefully to avoid performance loss.
Finisher	**After 25 days**	Finisher feeds account for most of the total feed intake and cost of feeding a broiler, and must be designed to optimize financial return for the type of product being produced. Broilers fed beyond 42 days of age will require an additional finisher feed.

*Diets should be regularly sampled, and the samples analyzed to ensure nutrient content is correct.

Withdrawal Periods

A withdrawal feed will be required when regulated pharmaceutical feed additives are used.

Refer to product instructions to determine the withdrawal time required.

Extreme dietary nutrient reductions are not recommended during the withdrawal period.

Separate Feeding of Male and Female Broilers

Feed the same feed to both sexes.

Keep the duration of starter feed the same for both sexes.

Shorten the feeding period of grower for females.

Feed Form and Physical Feed Quality

Feed form and recommended particle size by age in broilers.

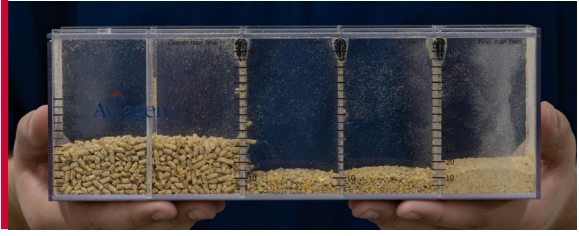
Age (days)	Feed Form	Particle size
0–10	Crumble	2–3.5 mm (0.08–0.14 in) diameter
11–18	Pellet	3–5 mm (0.12–0.20 in) diameter 5–7 mm (0.20–0.28 in) length
19–finish	Pellet	3–5 mm (0.12–0.20 in) diameter 6–10 mm (0.24–0.40 in) length

A good-quality sieved crumble, pellet, and mash feeds (left, middle and right).

MANAGEMENT FUNDAMENTAL

Poor physical feed form will have a negative impact on broiler performance.

Example of a feed shaker sieve for assessing physical feed quality.



Recommended particle size distribution for crumble or pelleted feeds.

Form	0–10 days Crumble	11–18 days Pellet	19–finish Pellet
>3 mm (0.12 in)	<20%	>80%	>80%
1–3 mm (0.04–0.12 in)	70%	10%	10%
<1 mm (0.04 in)	<10%	<10%	<10%

For mash feed, the aim is to minimize the amount of particles <1 mm (0.04 in).

Whole Grain Feeding

Proper adjustment of nutrient levels in compound feed ensures broiler performance and profitability with whole grain (wheat, oats, or barley) feeding.

Whole grain feeding reduces feed costs but requires careful management to avoid yield loss.

Safe inclusion levels of whole grain in broiler rations.

Form	Inclusion rate of whole grain
Starter	Zero
Grower	Gradual increase to 15–20%
Finisher	Gradual increase to 25–30%

These guidelines should be used together with the recommended ***Broiler Nutrition Specifications***.

- The grain being fed must be of good quality, free from fungal/toxin contamination, and treated for *Salmonella*.
- Caution must be exercised when using anticoccidial or other pharmaceutical products to ensure usage levels are not violated.
- Whole grain must be removed from the feed two days before catching.

Feeding Under Hot Environmental Temperature Conditions

- Provide correct balanced nutrient levels and use more digestible ingredients.
- Optimize feed form.
- Ensure birds have access to feed during the cooler part of the day.
- Provide good quality cool water.
- Consider the strategic use of vitamins and electrolytes to help the birds deal with heat-related environmental stresses.

Drinking Systems

Drinker type and requirements.

Drinker Type	Requirements (post-brooding)
Nipple	<3 kg (6.6 lb) 12 birds per nipple >3 kg (6.6 lb) 9 birds per nipple
Bell	8 drinkers (40 cm/15.7 in [diameter]) per 1,000 birds

Birds should have access to clean, fresh, good-quality drinking water at all times.

Monitor the feed-to-water ratio daily.

At 21°C (69.8°F), birds are consuming sufficient water when the ratio of water volume (L) to feed weight (kg) remains close to 1.6–1.8:

The water-to-feed ratio may be higher than this for the first few days and will vary with ambient temperature.

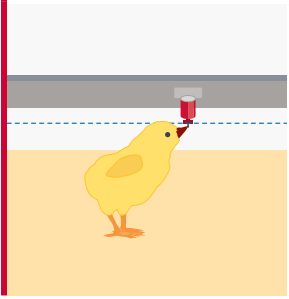
Water useage = water consumption + water sillage.

Ideal water temperature should be between 18°C (64.4°F) and 21°C (69.8°F).

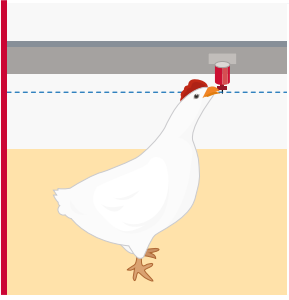
Provide supplementary drinkers for the first 3 days of a flock's life.

Adjust drinker heights daily.

Correct nipple drinker height for birds under 7 days old (bird's back-to-floor angle: 35–45°).



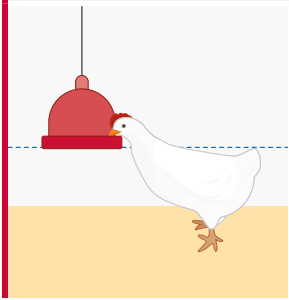
Correct nipple drinker height after 7 days (bird's back-to-floor angle: 75–85°).



Correct height of bell drinker.

Place bell drinkers throughout the house.
Broilers should not have to travel more than 2 m (6.6 ft) to get water.
Water level should be 0.6 cm (0.2 in) below the top of the drinker until 7–10 days of age.
After ten days there should be 1 cm (0.24 in) of water in the base of the drinker.
Keep drinkers well-maintained and clean.
In hot weather, water consumption will be increased and drinker lines should be flushed at regular intervals to keep water cool.

Correct height of bell drinker.



Recommended nipple line flow rates at a particular age for broilers.

Bird Age (Days)	Water Intake ml/min (oz/min)
0–7	20–29 (0.68–0.98)
8–14	30–39 (1.01–1.32)
15–21	40–49 (1.35–1.66)
22–28	50–69 (1.69–2.33)
>28	70–100 (2.37–3.38)

These rates are only guidelines. Follow the manufacturer's guide and closely monitor the uniformity of flow rate, water consumption, and birds' behavior.

Measuring nipple line flow rates.

Feeding Systems

Feeding space per bird for different feeder types.

Feeder Type	Feeding Space
Pan	45–80 birds per pan (the lower ratio for birds >3.5 kg [7.7 lb]).
Flat Chain/Auger*	2.5 cm/bird (0.98 in/bird)
Tube	70 birds/tube (for a 38 cm/15.0 in diameter)

*Birds fed on both sides of the track.

- Adjust feeder height daily so that the lip of the feeder is level with the top of the breast.
- Feed must be distributed equally and uniformly throughout the feeding system.
- Allow the birds to clear the feeders once daily from days 10–12.
- Immediately re-fill once cleared.

Correct height of feeders.

SECTION 6

Environmental Requirements

Air Quality

The main contaminants of air within the house environment are dust, ammonia, CO_2, carbon monoxide, and excess water vapor. Levels of these contaminants must be kept within legal limits at all times.

During the first 30 to 60 seconds of entering the house ask the following questions:

1. Does it feel stuffy?
2. Is the air quality acceptable?
3. Is humidity too high or too low?
4. Does it feel too cool or too warm in the house?

MANAGEMENT FUNDAMENTAL

Evaluating bird behavior is the best way to verify if ventilation settings are correct.

Effects of common parent stock house air contaminants.

Ammonia	Ideal level <10 ppm. Can be detected by smell at 20 ppm or above. >10 ppm will damage lung surface. >20 ppm will increase susceptibility to respiratory diseases. >25 ppm may reduce growth rate depending upon temperature and age.
Carbon Dioxide	Ideal level <3,000 ppm. >3,500 ppm causes ascites. Carbon dioxide is fatal at high levels.
Carbon Monoxide	Ideal level <10 ppm. >50 ppm affects bird health. Carbon monoxide is fatal at high levels.
Dust	Damage to respiratory tract lining and increased susceptibility to disease. Dust levels within the house should be kept to a minimum.
Humidity	Ideal level 50–60% after brooding. Effects vary with temperature. At >29°C (84.2°F), if RH is >70% or < 50%, particularly during brooding, performance will be affected.

Open-Sided/Naturally-Ventilated Housing

Natural ventilation requires continuous 24-hour management.

Adequate heating equipment in natural ventilation/open-sided houses will be helpful for temperature control.

Adjust curtains in response to any changes in environment.

Circulation fans should be used to supplement and enhance temperature control within the house.

Special care is needed in hot and cold weather conditions.

Adequate heating equipment in natural ventilation/open-sided houses will be helpful for temperature control.

Curtain Management

Adjust curtains in response to any changes in environment.

Curtains should be managed carefully to minimize drafts and maintain bird comfort, opening from the top down and adjusting based on wind direction, weather, and bird behavior.

For young birds, limit top curtain openings to 1 m (3.3 ft) and adjust gradually based on birds' behavior.

The top curtain can be closed if it rains to prevent water from entering the house and reduce any wind-chill effects.

The bottom curtain can be opened up for improved ventilation and air exchange during the hottest parts of the day.

During periods of cold weather, circulation fans can create air movement in the house and improve the uniformity of conditions throughout.

In hot weather conditions

- Reduce stocking densities.
- Ensure adequate roof insulation is in place; spraying water on the external roof surface will help keep it cool (use with caution as this may raise RH levels inside the house).
- Use circulation fans to create air movement over the birds.
- Using a tunnel ventilation system with evaporative cooling.

Circulation Fans

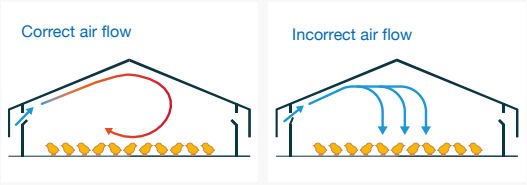
- Circulation fans should supplement and enhance temperature control within the house.
- Circulation fans can create air movement in the house and improve the uniformity of conditions throughout. It has the advantage of creating wind chill on warm days for additional cooling.

Closed-/Controlled-Environment Housing

- Closed-/Controlled-environment broiler houses should be equipped to meet the demands of the 3 stages of ventilation.
  - Minimum ventilation.
  - Transitional ventilation.
  - Tunnel ventilation.

Controlled-Environment Housing

Achieve good air flow and volume.



If incoming airflow speed and volume is too low:

- Cold air will drop directly on to the birds/litter.
- Birds become stressed and possibly causing wet litter.

Ensure the house is tightly sealed.

- Ventilation only works effectively if the house is adequately sealed and there are no air leaks.
- This ensures that airflow speed and volume entering the house are controlled and correct.

Uniform air inlet openings.

Open air inlets must be evenly distributed through the house and be opened equally.

This will create uniform:

- Volume of airflow.
- Speed of airflow.
- Direction of airflow.
- Distribution of airflow.

Air inlets must be managed based on the operating fan capacity.

Monitor and evaluate air speed regularly.

Monitor house pressure and air speed:

- For every increase in negative pressure of 3–4 Pa (0.012–0.016 inches of water column) air will travel ~ 1 m (3.3 ft) into the house.
- Incoming air should be thrown into the center of the house.

Use smoke tests or ribbon tape to confirm airflow direction and inlet settings are correct.

Monitor bird behavior.

Complete regular evaluation of:

- Air quality.
- Relative humidity.
- Signs of condensation.
- Dust levels.
- Litter quality.
- Bird behavior.

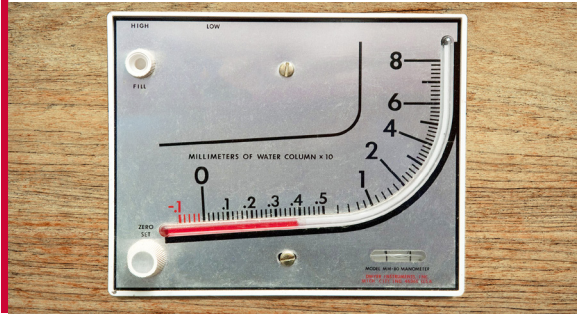
PROCEDURE

Evaluating Negative Pressure of Controlled-Environment Housing*

1. **Close all doors and inlets in the house.**
2. **Switch on one 127 cm (50 in) fan, or two 91 cm (36 in) fans.**
3. **The pressure in the house should not measure less than 37.5 Pa (0.15 inches of water column).**

*The above is based on a house with ±1,850 m^2 (19,900 ft^2) floor area. For example, 15 m (49 ft) wide x 123 m (404 ft) long. Smaller floor areas should achieve higher test pressure, and larger floor areas may be less. The pressures mentioned in this test are NOT operating pressures. They are only used to determine/indicate how well sealed the house is.

A manometer used to monitor air pressure within the house (the reading given is equivalent to 3.8 mm [0.15 in] of water column [37.5 Pa]).



Minimum Ventilation

It is essential to provide some ventilation to the house regardless of the outside conditions.

Minimum ventilation is used when the house temperature is below the house set point temperature (bird comfort temperature), or within 2°C (3.6°F) above the set point (dependent on the age of the birds).

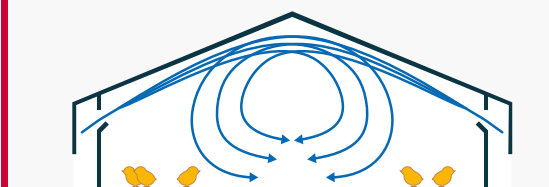
Extraction fans operating on a cycle timer (on/off) draw air into the house through sidewall or ceiling air inlets.

It is recommended that a 5 minute cycle timer (ON + OFF time = 5 minutes) is used.

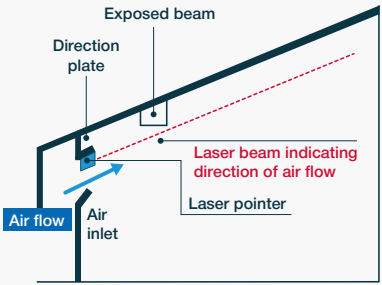
Air inlets should be opened at least 3–5 cm (1.2–2.0 in) for the airflow into the house to be effective.

Accurate ventilation settings for the house can be determined by carrying out smoke tests. Alternatively, ribbon tape can be hung from the ceiling every 1–1.5 m (3–5 ft) in front of an air inlet up to the apex of the house.

Correct airflow during minimum ventilation.



Direction plate in correct position.



Direction plate in correct position. Laser pointer shows air flow will bypass exposed beam and continue to the ceiling apex.

MANAGEMENT FUNDAMENTAL

Monitor airflow, bird distribution and bird behavior to determine if settings are correct.

Minimum Ventilation Rates

Minimum ventilation requirements are shown below.

During minimum ventilation, the actual air speed at floor level should be no more than 0.15 m/sec (30 ft min).

Maximum levels of RH, carbon monoxide, carbon dioxide and ammonia should never be exceeded (see the table in the Air Quality section on page 51).

Approximate minimum ventilation rates (per bird) for temperatures between -1 and 16°C (30 and 61°F).

Average Weight kg (lb)	Ventilation Rate* m^3/hr (ft^3/hr)
2.20 (4.85)	1.56 (0.92)
2.40 (5.29)	1.67 (0.98)
2.60 (5.73)	1.77 (1.04)
2.80 (6.17)	1.87 (1.10)
3.00 (6.62)	1.97 (1.16)
3.20 (7.06)	2.07 (1.22)
3.40 (7.50)	2.16 (1.27)
3.60 (7.94)	2.26 (1.33)
3.80 (8.38)	2.35 (1.39)
4.00 (8.82)	2.44 (1.44)
4.20 (9.26)	2.53 (1.49)
4.40 (9.70)	2.62 (1.55)
4.60 (10.14)	2.71 (1.60)
4.80 (10.58)	2.80 (1.65)
5.00 (11.03)	2.89 (1.70)

*This table should only be used as a guideline, as actual rates may need to be adjusted to environmental conditions, bird behavior, and bird biomass (total bird weight in the house).

PROCEDURE

Calculating Minimum Ventilation Requirement

1. **Determine the average body weight of birds in the house.**
2. **Select the appropriate ventilation rate for average body weight in the house.**
3. **Calculate the minimum ventilation requirement.**

Minimum ventilation requirement per bird (m^3/hr or ft^3/min) **X** **Number of birds in the house** **=** **Appropriate minimum house ventilation requirement.**

Employ the following steps to determine the interval fan timer settings for minimum ventilation.

PROCEDURE

Calculating Cycle Timer Settings

1. **Calculate the minimum ventilation requirement (m^3/hr or ft^3/min).**
2. **Calculate the percentage time the fans need to be running.**

$$\text{Percentage of time (\%)} = \frac{\text{Minimum ventilation requirement}}{\text{Total capacity of fans being used}} \times 100$$

Transitional Ventilation

Transitional ventilation is used when the house temperature increases above the desired (or set point) temperature, but it is not yet warm enough to use tunnel ventilation.

As a general guideline for transitional ventilation, there should be sufficient side inlets to be able to use 40–50% of the tunnel fan capacity without opening the tunnel inlets. It is acceptable to use only tunnel fans, or a combination of sidewall and tunnel fans.

During transitional ventilation, the tunnel inlet must be closed and all air enters only through the side inlets. The inlets direct the air along the ceiling to the middle of the house (as in minimum ventilation). The fans run continuously, and the heaters are off.

Tunnel Ventilation

Keeps the birds feeling cool.

Switch from transitional ventilation to tunnel ventilation when birds need the cooling effect of wind chill.

Younger birds that are not fully feathered will feel a greater wind chill than older birds and so are more prone to chilling.

Wind chill is used to describe how air temperature is perceived by the bird (effective temperature) when a combination of air temperature and air speed move across the bird's body. A higher wind speed means a greater cooling effect.

PROCEDURE

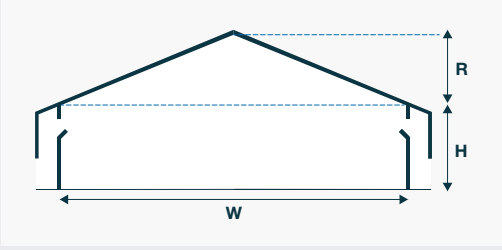
Tunnel Ventilation Calculations

1. Determine the fan capacity required for a given air speed.

Required fan capacity = design air speed x cross section area

Where:

Design air speed (min).
2.03 m/sec or 400 ft/min for rearing.



Cross section area = 0.5 x W x R + W x H.

Cross section area is the effective area through which the air flows down the length of the house. If there are other major obstructions, then the area of these obstructions can be subtracted from the total cross section area.

2. Determine the number of fans required:

$$\text{Number of fans} = \frac{\text{Required fan capacity}}{\text{Capacity per fan at assumed pressure}}$$

Evaporative Cooling Systems

Evaporative cooling is the cooling of air through the evaporation of water.

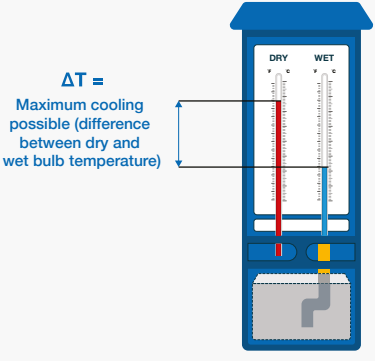
Effectiveness of evaporative cooling systems depends on the RH levels.

Evaporative cooling adds moisture to the air and increases RH. It is important to operate the system based on RH, as well as dry bulb temperature, to ensure bird welfare.

MANAGEMENT FUNDAMENTAL

If in-house RH levels reach more than 70%, turn off the evaporative cooling system.

Maximum cooling possible during evaporative cooling is about 70-85% of the difference between dry and wet bulb temperature.



Fogging/Misting

Fogging systems cool incoming air by evaporation of water created by pumping water through spray/fogger nozzles.

There are three types of fogging systems:

Low pressure, 7–14 bar; droplet size up to 30 microns.
High pressure, 28–41 bar; droplet size 10–15 microns.
Ultra high-pressure (misting), 48–69 bar; droplet size 5 microns.

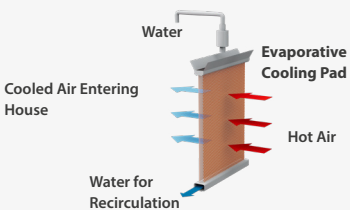
Fogging lines must be placed near air inlets in order to maximize the speed of evaporation, and additional lines should be added throughout the house.

Pad Cooling

In pad cooling systems, cool air is drawn through a wet cooling pad by the tunnel ventilation fans.

Cooling pad area (m^2) = total operating fan capacity (m^3/hr) ÷ design air speed through cooling pads (m/s) ÷ 3,600
or
Cooling pad area (ft^2) = total operating fan capacity (cfm) ÷ design air speed through cooling pads (fpm)

Pad cooling with tunnel ventilation.



Evaluating Ventilation

Spread/distribution of the birds:

- Are they well spread?
- Are there specific areas of the house that are being avoided?

Bird activity:

- Birds should be feeding, drinking, or resting /moving around.
- Are they sitting, huddling together and showing signs of being cold?
- Are they holding their wings away from their bodies, showing signs of being too warm?
- In addition to thermometer/sensor readings, visible bird comfort and behavior are the best indicators of how well the ventilation system is being operated.

Bird Heat Loss

There are two methods by which birds are able to lose heat, sensible heat loss (SHL) and latent heat loss (LHL).

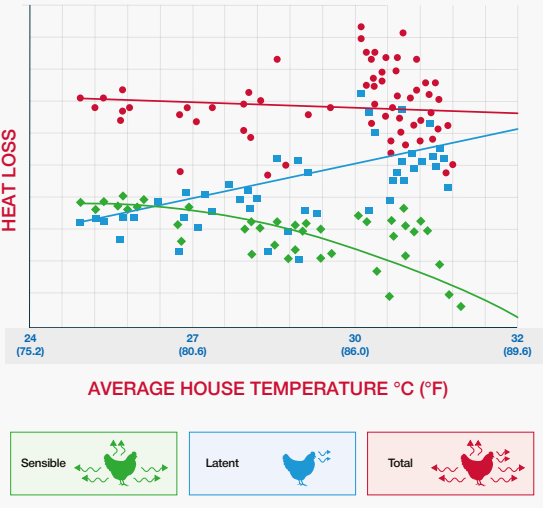
- When air temperature is "cool", most of the heat loss comes from SHL, because the bird is able to lose warm air from its body to the surrounding cooler air.
- As house temperature increases, the bird's ability to lose heat to the air via SHL decreases. The bird will begin to pant to lose heat via evaporative cooling, known as LHL.

Because LHL involves the evaporation of moisture from the respiratory system of the bird, it is important to try to minimize the RH in the house as much as possible in the given ambient climate.

High air speed and a short air exchange time are critical in hot and humid climates.

An evaporative cooling system should always operate based on a combination of temperature and RH, and never based purely on temperature and/or time of day.

Sensible and latent heat loss.



Lighting

Lighting Program

The lighting program provided must comply with local laws and regulations, and will depend on individual flock circumstances and market requirements, but the following recommendations will benefit bird welfare and biological performance.

Day 0–7: chicks should have 23 hours light and 1 hour dark from the first day, and gradually reduced to 4–6 hours of darkness by 7 days.

After 7 days: dark period of 4–6 hours.

Continuous or near continuous lighting is not optimal.

Changes to a lighting program should be gradual over a period of 2–3 days, rather than one abrupt change.

A dawn-to-dusk program in addition to the lighting program will result in gradual movement of birds toward the feeders and less crowding at the feeders and drinkers.

Intermittent lighting programs should be simple, providing at least one continuous block of four hours of darkness. Adequate feeder and drinker space must be provided.

Considerations for Lighting Management

- Poultry vision differs from humans in how they receive light, color spectrum, and sensitivity to flicker.
- The K value indicates the light's dominant wavelength, helping select the right bulb for flock needs. Broilers <2 kg (4.4 lb) need 5,000–6,000 K, while >2 kg (4.4 lb) need 3,500–4,500 K.
- The provision of cooler light toward the blue/green end of the spectrum can promote calmness.
- Violet to green light may be beneficial to broiler growth.
- Provide a minimum light intensity of 30–40 lux (2.8–3.7 fc) to 7 days of age. Thereafter, provide an intensity of at least 5–10 lux (0.5–0.9 fc). Local laws and regulations must be adhered to at all times.
- During the dark period, light intensity must remain below 0.4 lux (0.04 fc).
- Light must be uniformly distributed throughout the poultry house, keeping variation between light and dark areas to <30%.
- Use a light meter appropriate for the light source to verify light intensity.
- In hot weather or in open-sided housing, the period of artificial light should be given at a time that maximizes bird comfort.

Litter Management

Causes of poor litter quality.

Litter Material

Poor quality litter material.

Insufficient litter depth.

Drinker Management

Water pressure too high.

Incorrect drinker height.

Environmental Management

Poor management of the ventilation system.

Insufficient preheating of the house prior to placement.

Stocking Density

High overall stocking density.

Localized high stocking density due to drafts, light, etc.

Nutrition

High salt diets.

High protein diets.

Poor-quality fats used.

Health

Enteritis due to disease.

Nutritional Strategies to Manage Litter Quality

Use broiler feeds with the correct level of balanced protein (BP).

Avoid excessive sodium (Na), chloride (Cl), and potassium (K), which will increase water intake and contribute to wet litter conditions.

Provide an effective anticoccidial program that improves gut health and maintains good litter quality.

Consider all plant protein-based nutrition specifications to optimize enteric health, litter quality, and performance with shorter feeding phases and slightly lower BP levels.

Perch Provisions for Broilers

Perches allow broilers to find cooler areas, reducing heat stress and leg issues, improving performance and welfare.

Platform perch provision encourages perching behavior.

Stocking Density

Adjust stocking density to allow for the age and weight at which the flock will be processed.
Match stocking density to the climate and housing system.
Reduce stocking density if target house temperatures cannot be achieved due to hot climate or season.
Adjust ventilation as well as feeding and drinking space if stocking density is increased.
Follow local laws and regulations and requirements of quality assurance standards set by product purchasers.

SECTION 7

Health and Biosecurity

Bird Health and Biosecurity

Elements of disease exposure.

Decreasing the Risk of Disease

Preventing Diseases Transmitted by Humans

Prevent unauthorized access to the farm.
Shower onto the farm and change clothing and footwear.
Maintain a record of visitors.
Wash and sanitize hands and boots when entering and leaving each house.
Only necessary items can be taken into the house and only after they have been properly cleaned and disinfected.
If visiting multiple farm is unavoidable, visit youngest flocks first.

Preventing Diseases Transmitted by Animals

Whenever possible, use an "all in/all out" placement cycle.
Downtime between flocks will reduce farm contamination.
Keep all vegetation cut 15 m (49.2 ft) away from the buildings to prevent entry of rodents and wild animals.
Do not leave equipment, building materials, or litter lying around.
Clean up feed spills as soon as they occur.
Store litter material in bags or inside a storage building or bin.
Ensure all buildings are adequately sealed against access by wild animals.
Maintain an effective rodent/vermin control program, including mechanical, biological, and chemical controls.

Site Cleaning

MANAGEMENT FUNDAMENTAL

Site cleaning must cover both the interior and exterior of the house, all equipment, external house areas and the feeding and drinking systems.

PROCEDURE
Site Cleaning
1. Plan.
2. Control insects: Once the flock has been removed, while the house is still warm, spray litter, equipment and surfaces with an insecticide.
3. Remove all equipment.
4. Remove and dispose of litter to a distance of at least 3.2 km (2.0 mi).
5. Remove dust.
6. Pre-spray with an approved detergent solution throughout the inside of the house.
7. Wash using a pressure washer with foam detergent, and rinse with hot water (54.4–60.0°C/130–140°F).
8. Thoroughly clean staff facilities and staff equipment as well.
9. Ensure all external areas are thoroughly cleaned.

PROCEDURE
Cleaning the Water System
1. Drain pipes and header tanks.
2. Clean the regulator.
3. Flush lines with clean water.
4. Scrub header tanks to remove scale and biofilm deposit and drain to the exterior of the house. If physical cleaning is not possible, cleaning of water lines between flocks using peroxygen compounds.
5. Refill the header tank with fresh water and add an approved water sanitizer.
6. Run the sanitizer solution through the drinker lines from the header tank, ensuring that there are no airlocks.
7. Fill header tank to normal operating level with additional sanitizer solution at appropriate strength.
8. Replace lid. Allow the disinfectant to remain for a minimum of 4 hours.
9. Drain and rinse with fresh water.
10. Refill with fresh water prior to chick arrival.
11. Analyze water samples regularly for total viable counts (TVC).

PROCEDURE
Cleaning the Feeding System
1. Run auger systems out and ensure no feed is left.
2. Empty, wash, and disinfect all feeding equipment.
3. Empty bulk bins and connecting pipes, and brush-out where possible. Clean out and seal all openings.
4. Ensure feed lines and equipment are allowed to dry properly if wet-washed.
5. Fumigate wherever possible.

Disinfection

Disinfection should not occur until all cleaning and repairs are done.
Use an approved disinfectant and follow manufacturers' instructions at all times.
Apply disinfectant using either a pressure-washer or a backpack sprayer.
Heating houses to high temperatures after sealing can enhance disinfection.
Use a selective coccidial treatment (flaming, salt, phenolic disinfectants, or ammonia [where permitted]) to reduce environmental oocyst challenges.

Formalin Fumigation

Where formalin fumigation is permitted, it must be conducted by trained personnel following local safety laws and regulations.
Fumigation should be undertaken as soon as possible after disinfection has been completed.
Surfaces should be damp, the house warmed to a minimum of 21°C (69.8°F) and RH greater than 65%.
After fumigation, keep the house sealed for 24 hours with NO ENTRY signs clearly displayed.
The house must be thoroughly ventilated before anyone enters.
After clean litter has been spread, fumigation should be repeated.

Evaluation of Farm Cleaning and Disinfection Efficiency

Monitor the efficacy and cost of cleaning out and disinfection.
Complete *Salmonella* isolations and total viable bacterial counts (TVC).
When disinfection has been carried out effectively, the sampling procedure should not isolate any *Salmonella* species.
For a detailed description of where to sample, and recommendations of how many samples to take, please consult a veterinarian.

Water Quality

Ideal water quality criteria for poultry.

Water quality criteria for poultry.

Criteria	Concentration (ppm)	Comments
Total Dissolved Solids (TDS)	<1,000	Good
	1,000–3,000	Satisfactory
	3,000–5,000	Poor
	>5,000	Unsatisfactory
Hardness	<100 Soft	Good
	>100 Hard	Satisfactory
pH	<6	Poor
	6.0–6.4	Poor
	6.5–8.5	Satisfactory
	>8.6	Unsatisfactory
Sulfates	<200	Satisfactory
	200–250	Maximum
	250–500	May have a laxative effect
	500–1,000	Poor
	>1,000	Unsatisfactory
Potassium	<300	Good
	>300	Satisfactory

Water quality criteria for poultry *(Continued)*.

Criteria	Concentration (ppm)	Comments
Chloride	<250	Satisfactory
	250–500	Acceptable with caution
	>500	Unsatisfactory
Magnesium	50–125	Satisfactory
	>125	Laxative effect with intestinal irritation
	300	Maximum
Nitrate Nitrogen	10	Maximum
Nitrates	Trace	Satisfactory
	>Trace	Unsatisfactory
Iron	<0.3	Satisfactory.
	>0.3	Unsatisfactory
Fluoride	2	Maximum
	>40	Unsatisfactory
Bacterial Coliforms	0 colony forming unit (CFU)/mL	Ideal
Calcium	60	Average level
Sodium	50–300	Satisfactory

*If there are issues with intestinal health, a more acidic water pH of 5–6 will be beneficial.

Test water quality at least once a year (more often if there are perceived water quality issues or performance problems). After house cleaning and prior to chick placement, sample water for bacterial contamination at source, the storage tank, and the drinker points.

Chlorination (where allowed) at 3–5 ppm free chlorine, maintaining a pH of 6.5–8.5 for effectiveness, is usually effective in controlling bacteria at the drinker level, but its success depends on the type of chlorine component used.

Measuring oxidation-reduction potential (ORP) is an effective way to evaluate the activity of water sanitizers and ensure the sanitation program is working. Ideal range 650–800mV.

Ultraviolet light (applied at the point of drinking water entry to the house) can also be used to disinfect water.

Manufacturers' guidelines should be followed when establishing this procedure.

Where hard water is a problem or iron levels are greater than 3 mg/L, water should be filtered using a 40–50 micron filter.

It is a good idea to routinely check the water supply on the farm during a flock:

- Run water out of the end of each line.
- If there is a high level of organic or suspended matter visible to the naked eye, take action to rectify the issue.

An example of an ORP meter.

Disease Control

Keep records and monitor flock health.
Good management and biosecurity will prevent many poultry diseases.
Monitor feed and water intake for the first signs of a disease challenge.
Respond promptly to any signs of a disease challenge by completing post-mortem examinations and contacting the local veterinarian.
Salmonella infection via feed is a threat to bird health. Heat treatment and monitoring raw materials will minimize the risk of contamination.
Only use antibiotics to treat disease and with veterinary supervision.

Vaccination

- Vaccination promotes an immunological response to protect birds from diseases, including Marek's disease (MD), Newcastle disease (ND), infectious bronchitis (IB), and infectious bursal disease (IBD or Gumboro disease), among others, the challenge should be routinely considered when a vaccination program is prepared for broilers.
- Vaccination programs must be tailored to local challenges with veterinary guidance, considering local disease pressure, vaccine availability, and avoiding vaccinating sick or stressed birds.
- Vaccine effectiveness should be evaluated through titers, clinical signs.
- Vaccination alone cannot protect flocks against overwhelming disease challenges and/or poor management and biosecurity practices.
- Only necessary vaccines should be used to reduce costs and maximize response, ensuring reputable sources and proper administration methods.
- Broiler vaccines include live (attenuated and nonattenuated), killed (inactivated), and recombinant types. Some vaccination programs may be combined to promote maximum immunological response.
- Coccidiosis can be managed through in-feed anticoccidial medications or vaccination.
- Every bird must receive the intended dose of vaccine.
- Properly discard vaccine bottles and vials after use.

Factors for a successful vaccination program.

Vaccination Program(s) Design

Design programs with veterinary advice, tailored to local challenges from health surveys and lab analysis.

Choose vaccines based on flock age, health, and type.

Ensure consistent immunity with minimal adverse effects.

Broiler breeder programs should provide maternal antibodies to protect chicks early against diseases like inclusion body hepatitis (IBH), IBD, and Reovirus.

Maternal antibodies may affect vaccine response and decline as breeders age.

Vaccine Administration

Follow manufacturer guidelines for vaccine handling and administration.

Ensure vaccine administrators are properly trained in handling and administration.

Maintain accurate vaccination records.

For live vaccines in sanitized water, stop sanitization 24–48 hours before adding the vaccine and use a commercial stabilizer (or non-fat powdered/liquid milk if unavailable).

Factors for a successful vaccination program *(Continued)*.

Vaccine Effectiveness

Consult a vet before vaccinating sick or stressed birds.

Clean houses and replace litter regularly to reduce pathogens.

Allow adequate downtime between flocks to minimize pathogens and boost performance.

Audit vaccine handling, administration, and responses to improve performance.

Optimize ventilation and management post-vaccination, especially during reactions.

Assess vaccine effectiveness using enzyme-linked immunosorbent assay (ELISA) titers or polymerase chain reaction (PCR).

Disease Investigation

The tables below highlight examples of mortality parameters possibly related to bird quality and bird health giving potential investigative actions.

Troubleshooting common issues in the 0–7 day brooding phase.

Observe

Poor Chick Quality:

Increased dead on arrivals (DOA).

Chicks are inactive and slow to respond, lacking energy.

General chick appearance:

- Unhealed navels.
- Red hocks/beaks.
- Dark, wrinkled legs.
- Discolored or malodorous yolks or navels.

Investigate

Flock Status, Egg and Chick Handling and Transport, Sanitation:

Source flock health and hygiene status.

Egg handling, storage, and transport.

Hatchery sanitation, incubation, and management.

Chick processing, handling, and transport.

Likely Causes

Inadequate diet of source flock.

Health and hygiene status of source flock, hatchery, and equipment.

Incorrect parameters for egg storage, RH, temperatures, and equipment management.

Incorrect moisture loss during incubation.

Incorrect incubation temperature.

Dehydration caused by excessive spread of hatch time or late removal of chicks.

Troubleshooting common issues in the 0–7 day brooding phase *(Continued)*.

Observe

Small Chicks on Days 1–4.

Investigate

Feed, Light, Air, Water, and Space:

Crop fill in the first 2–4 hours post-chick placement.

Availability and accessibility to feed and water.

Bird comfort and welfare.

Low or poor uniformity of light intensity.

Brooding setup.

Likely Causes

Less than 75–80% of chicks with adequate crop fill by the first 2–4 hours after placement.

Young donor flocks.

Weak chicks.

Equipment location and maintenance issues.

Inappropriate brooding temperature and environment.

Troubleshooting common issues in the 0–7 day brooding phase *(Continued)*.

Observe

Runted and Stunted Chicks:

Small birds, as early as 4–7 days.

Investigate

Feed, Light, Litter, Air, Water, Space, Sanitation, and Biosecurity:

Flock source.

Hydration status of chicks.

Brooding conditions.

Feed quality and accessibility.

Downtime between flocks.

Disease challenge.

Likely Causes

Chicks sourced from a wide range of donor flock ages.

Chicks unable to find or reach water.

Incorrect brooding temperatures.

Chicks unable to find feed or have poor feed quality.

Short downtimes between flocks (<10 days).

Inadequate cleaning and disinfection.

Disease.

Poor biosecurity and hygiene practices.

Troubleshooting common issues after 7 days of age.

Observe

Disease:

Metabolic.	Fungal.	Parasitic.
Bacterial.	Protozoal.	Toxins.
Viral.		

Investigate

Feed, Light, Litter, Air, Water, Space, Sanitation, and Biosecurity:

Broiler farm hygiene.

Local disease challenge.

Vaccination and disease prevention strategies.

Feed quality and supply.

Lighting and ventilation.

Likely Causes

Poor environmental conditions.

Poor biosecurity.

High disease challenge.

Low disease protection.

Inadequate or improper implementation of disease prevention.

Poor feed quality.

Poor bird access to feed.

Excessive or insufficient ventilation.

Troubleshooting common issues after 7 days of age *(Continued).*

Observe

Unusual Bird Behavior.

Investigate

Potential Sources:

Temperature.

Management of CO_2 levels.

Immunosuppressive disorders.

Likely Causes

Inadequate environmental management.

Inadequate equipment.

Inadequate bird comfort and welfare.

Troubleshooting common issues after 7 days of age *(Continued).*

Observe

High Number of Birds DOA to the Processing Plant:

High plant condemnation rate.

Investigate

Feed, Light, Litter, Air, Water, Space, Sanitation, and Biosecurity:

Flock records and data. Health status of the flock.

History of the flock during the growing period (such as feed, water, or power outages).

Potential equipment hazards on the farm.

Bird handling by the catchers, handlers, and transporters.

Experience and training level of individuals handling and transporting birds.

Conditions during catching and transporting (such as weather and equipment).

Likely Causes

Health issues during growing period.

Management of relevant historical events affecting bird health and welfare.

Improper bird handling and hauling by crews.

Harsh conditions (weather- or equipment-related) during handling, catching, or transport to the processing plant.

Disease Recognition

Recognizing signs of disease.

Observations by Farm Personnel	Farm and Laboratory Monitoring	Data and Trend Analysis
Daily assessment of bird behavior.	Regular farm visitation.	Daily and weekly mortality.
Bird appearance (such as feathering, size, uniformity, and coloring).	Routine post-mortem examinations of normal and sick birds.	Water and feed consumption.
Environmental changes (such as litter quality, heat or cold stress, and ventilation issues).	Proper sample collection size and type.	Temperature trends.
Clinical signs of illness (such as respiratory noise or distress, depression, fecal droppings, and vocalization).	Proper choice of subsequent analysis and actions following post-mortem examination—needs validation/clarification.	DOA after placement on the farm or after arrival at the processing plant.
Flock uniformity.	Routine microbiological testing of farms, feed, litter, birds, and other appropriate material.	Condemnations at processing.
	Appropriate diagnostic testing.	
	Appropriate serology.	

APPENDICES

Production Records

Records Required in Broiler Production.

Event	Records	Comment
Chick placement	Number of day-old chicks received. Flock(s) of origin and flock(s) age. Date and time of arrival. Chick quality. Crop fill.	Check chick weight, uniformity, number of dead on arrival. Check crop fill percentage for time post-placement.
Mortality	Daily. Weekly. Cumulative.	Record by sex if possible. Record culls and reason for culling separately. Post-mortem records of excessive mortality. Scoring of coccidial lesions will indicate the level of coccidial challenge. Record actual numbers and percentages. Particular importance should be given to 7-day mortality.

Records Required in Broiler Production *(Continued)*.

Event	Records	Comment
Medication	Administration date. Amount. Batch number. Expiration date. Withdrawal periods.	As per veterinary instruction.
Vaccination	Date of vaccination. Disease vaccinated for. Vaccine type. Batch number. Expiration date.	Any unexpected vaccine reaction should be recorded.
Live weight	Weekly average live weight. Weekly uniformity (CV%/uniformity%).	More frequent measurement is required when predicting processing age/weight.
Feed	Date of delivery. Quantity. Feed type. Feed form. Date of starting feed withdrawal prior to catching.	Accurate measurement of feed consumed is essential to measure FCR and to determine the cost-effectiveness of the broiler operation. Check physical feed quality.

Records Required in Broiler Production *(Continued)*.

Event	Records	Comment
Water	Daily consumption. Water-to-feed ratio. Water quality. Level of chlorination.	Plot daily consumption in graph form, preferably per house. Sudden fluctuation in water consumption is an early indicator of problems. Mineral and/or bacteriological records (especially areas where wells/boreholes are present or open water reservoirs are used).
Depletion	Number of birds removed. Time and date of removal. Time of feed withdrawal. Number of birds removed due to being sick or small.	

Records Required in Broiler Production *(Continued)*.

Event	Records	Comment
Environment	Floor temperature. Litter temperature during brooding. External temperature. Daily minimum temperature. Daily maximum temperature. Relative humidity. Temperature and RH should be monitored: At least twice daily in the first 5 days. Once daily afterward. Air quality. Litter quality. Last calibration of equipment and by who.	Multiple locations should be monitored, especially in the chick brooding area. Automatic systems should be cross-checked manually each day. Ideally, record dust, CO_2, and NH_3 levels.
Lighting program	Dark and light period. Time on and time off.	Intermittent or not.

Records Required in Broiler Production *(Continued)*.

Event	Records	Comment
Information from processing plant	Dead on arrival (DOA). Carcass quality. Health inspection. Carcass composition. Type and percent of condemnations.	
Cleaning Out	Total viable counts (TVC).	After disinfection, *Salmonella, Staphylococcus,* or *E. coli* may be monitored if required.
House Inspection	Record the times of daily checks. Make note of any bird observations.	Behavior and environmental conditions.
Visitors	Who. Date. The purpose of the visit. Previous farm visits (place and date).	Complete for every visitor to ensure traceability.

Useful Management Information

Drinking Space during Brooding

Recommended drinking space requirements during brooding.

Drinker Type	Drinking Space
Bell	8 drinkers per 1,000 chicks (125 chicks per drinker)
Nipple	10–12 birds per nipple
Mini-drinker or tray	12 mini-drinkers per 1,000 chicks

Drinking Space Post-Brooding

Minimum drinking space requirements post-brooding.

Drinker Type	Drinking Space
Nipple	< 3 kg (6.6 lb) 12 birds per nipple > 3 kg (6.6 lb) 9 birds per nipple
Bell	8 drinkers (40 cm/ 15.7 inches in diameter) per 1,000 birds

Feed Form

Feed form and recommended particle size by age in broilers.

Age (days)	Feed Form	Particle size
0–10	Crumble	2–3.5 mm (0.08–0.14 in) diameter
11–18	Pellet	3–5 mm (0.12–0.20 in) diameter 5–7 mm (0.20–0.28 in) length
19–finish	Pellet	3–5 mm (0.12–0.20 in) diameter 6–10 mm (0.24–0.39 in) length

Flow Rate

Recommended flow rates at a particular age for broilers.

Bird Age (days)	Water Intake ml/min (oz/min)
0–7	20–29 (0.68–0.98)
8–14	30–39 (1.01–1.32)
15–21	40–49 (1.35–1.66)
22–28	50–69 (1.69–2.33)
>28	70–100 (2.37–3.38)

These rates are only guidelines. Follow the manufacturer's guide and closely monitor the uniformity of flow rate, water consumption, and birds' behavior.

Feeding Space during Brooding

Feeding space per bird for different feeder types.

Feeder Type	Feeding Space
Pan	Brooding: 100 chicks per pan (plus small amount on paper) Post-brooding: 45–80 birds per pan (the lower ratio for bigger birds [>3.5 kg/7.7 lb])
Flat Chain/Auger*	2.5 cm/bird (0.98 in/bird)
Tube	70 birds/tube (for a 38 cm/15.0 in diameter)

*Birds fed on both sides of the track.

Temperature and RH

Principles of how optimum dry bulb temperatures for broilers may change at varying RH. Dry bulb temperatures at the ideal RH at a weight less than 200 g (0.44 lb)+ are colored green.

Body Weight g (lb)	Dry Bulb Temperature °C (°F)			
	40 RH%	50 RH%	60 RH%	70 RH%
44 (0.10)	36.0 (96.8)	33.2 (91.8)	**30.8 (87.4)**	**29.2 (84.6)**
100 (0.22)	33.7 (92.7)	31.2 (88.2)	**28.9 (84.0)**	**27.3 (81.1)**
180 (0.40)	32.5 (90.5)	29.9 (85.8)	**27.7 (81.9)**	**26.0 (78.8)**
290 (0.64)	31.3 (88.3)	28.6 (83.5)	26.7 (80.1)	25.0 (77.0)
425 (0.94)	30.2 (86.4)	27.8 (82.0)	25.7 (78.3)	24.0 (75.2)
590 (1.30)	29.0 (84.2)	26.8 (80.2)	24.8 (76.6)	23.0 (73.4)
790 (1.74)	27.7 (81.9)	25.5 (77.9)	23.6 (74.5)	21.9 (71.4)
1015 (2.24)	26.9 (80.4)	24.7 (76.5)	22.7 (72.9)	21.3 (70.3)
1260 (2.78)	25.7 (78.3)	23.5 (74.3)	21.7 (71.1)	20.2 (68.4)
>1530 (3.37)	24.8 (76.6)	22.7 (72.9)	20.7 (69.3)	19.3 (66.7)

Temperature calculations based on a formula from Dr. Malcolm Mitchell (Scotland's Rural College).

This table provides general guidance; however, individual climatic conditions should be considered.

+Recent research suggests that RH is less critical for body weights between 200 g (0.44 lb) and 2,500 g (5.51 lb). Further studies are underway to assess RH effects at both lower and higher body weights.

Typical Lighting Program

A Guide to Typical Lighting Program.

Age (days)	Lighting Program	Notes
First Day	23 hours of light, minimum 30–40 lux (2.8–3.7 fc).	Ensure this program is followed immediately after placement.
	1 hour of dark, <0.4 lux (0.04 fc).	Light must be uniformly distributed throughout the brooding area.
Day 2–7	Gradually increase dark hours to 4–6 hours by day 7.	Adjust light and dark hours incrementally each day to avoid stress.
After Day 7	Minimum of 4 hours of continuous darkness. Light intensity of 5–10 lux (0.46–0.93 fc) during the light period.	Prefer to have the lights turning on at the same time each day.
Pre-catching	23 hours of light for at least 3 days before catching.	For thinning, adjust the schedule to a regular program.
	Light intensity: minimum 5–10 lux (0.46–0.93 fc).	Use brighter lights to encourage bird movement after thinning.

Local laws and regulations for light intensity should be adhered to.

Key Performance Parameters

Production Efficiency Factor (PEF)+

$$PEF = \frac{\text{Livability (\%)} \times \text{Live Weight (kg)}}{\text{Age (days} \times \text{FCR)}} \times 100$$

For example, age 35 days, live weight 2.296 kg, livability 97.20%, FCR 1.399.

$$PEF = \frac{97.20 \times 2.296}{35 \times 1.399} \times 100$$

$$= 456$$

For example, age 45 days, live weight 3.295 kg, livability 96.55%, FCR 1.606.

$$PEF = \frac{96.55 \times 3.295}{45 \times 1.606} \times 100$$

$$= 440$$

Notes

The higher the value, the better the performance.

This calculation is heavily biased by daily gain. When comparing different environments, comparisons should be made at similar processing ages.

+***Also referred to as European Production Efficiency Factor (EPEF).***

Manual calculation formula:

Where:

x_i = Value of the ith point in the data set

$\bar{x}$ = The mean value of the data set

n = The number of data points in the data set

$$\text{Standard deviation} = \sqrt{\frac{1}{(n-1)} \sum_{i=1}^{n} (x_i - \bar{x})^2}$$

Coefficient of Variation % (CV%)

$$CV\% = \frac{\text{Standard Deviation}}{\text{Average Body Weight}} \times 100$$

For example, a flock has an average body weight of 2,550 g (5.62 lb) and a standard deviation around that average weight of 250 g (0.55 lb).

$$CV\% = \frac{250\ g\ (0.55\ lb)}{2{,}550\ g\ (5.62\ lb)} \times 100$$

$$= 9.8$$

Notes

The lower the CV%, the more uniform and less variable the flock is. CV% is an important tool for estimating the flock's live weight. Please refer to the Monitoring Live Weight and Uniformity of Performance section in this handbook for more information.

Feed Conversion Ratio (FCR)

$$FCR = \frac{\text{Total Feed Consumed}}{\text{Total Live Weight}}$$

For example, a sample of 10 birds has a total live weight of 31,480 g (69.34 lb), and they have consumed a total feed amount of 36,807 g (81.07 lb). The average feed conversion for this sample set would be calculated as follows:

$$FCR = \frac{36{,}807\ g\ (81.07\ lb)}{31{,}480\ g\ (69.34\ lb)}$$

$$= 1.169$$

Notes

The lower the FCR, the more efficient a bird (or sample of birds) is at converting the feed consumed into live body weight.

Adjusted Feed Conversion Ratio (Adjusted FCR)

$$\text{Adjusted FCR} = \text{Actual FCR} + \frac{\text{Target Body Weight} - \text{Actual Body Weight}}{\text{Factor}}$$

The factor in the above equation will change depending on the units of measurement used. For an as hatched flock, a factor of 4.5 kg, 4,500 g, or 10 lb should be used, depending on the unit of measurement.
This equation provides a good estimation of adjusted FCR for broiler performance comparison. However, it is important to note that adjusting FCR to target weights beyond ±0.5 lb/0.227 kg/227 g of the actual weight can distort the comparison.

Example (Metric, unit in g)

$$\text{Adjusted FCR} = \text{Actual FCR} + \frac{\text{Target Body Weight} - \text{Actual Body Weight}}{4{,}500\ \text{g}}$$

$$\text{Adjusted FCR} = 1.215 + \frac{1{,}350\ \text{g} - 1{,}290\ \text{g}}{4{,}500\ \text{g}}$$

$$= 1.215 + (60\ \text{g}/4{,}500\ \text{g})$$
$$= 1.215 + 0.013$$
$$= 1.228$$

Example (Metric, unit in kg)

$$\text{Adjusted FCR} = \text{Actual FCR} + \frac{\text{Target Body Weight} - \text{Actual Body Weight}}{4.5\ \text{kg}}$$

$$= 1.215 + \frac{1.1350\ \text{kg} - 1.290\ \text{kg}}{4.5\ \text{kg}}$$

$$= 1.215 + (0.06\ \text{kg}/4.5\ \text{kg})$$
$$= 1.215 + 0.013$$
$$= 1.228$$

Example (Metric, unit in lb)

$$\text{Adjusted FCR} = \text{Actual FCR} + \frac{\text{Target Body Weight} - \text{Actual Body Weight}}{10\ \text{lb}}$$

$$= 1.215 + \frac{2.976\ \text{lb} - 2.844\ \text{lb}}{10\ \text{lb}}$$

$$= 1.215 + (0.132\ \text{lb}/10\ \text{lb})$$
$$= 1.215 + 0.013$$
$$= 1.228$$

Notes

Adjusted FCR is a useful calculation when you want to measure a flock's performance against a common target weight. It is also helpful when doing breed comparisons, as the flock can be analyzed at a specific target weight.

Problem Solving

Poor Live Performance.

Issue	Possible Causes	Action
High early mortality (< 7 days).	Poor chick quality.	Check hatchery practice, egg handling, and hygiene.
	Incorrect brooding.	Reassess brooding practice.
	Disease.	Post mortems on dead chicks —take veterinary advice.
	Appetite.	Measure and achieve target crop fill levels. Check feed and water availability, and accessibility.
High mortality (post-7 days).	Metabolic diseases (ascites, sudden death syndrome).	Check ventilation rates. Check feed formulation. Avoid excessive early growth rates. Check hatchery ventilation.
	Infectious diseases.	Establish cause (post-mortem). Take veterinary advice on medication and vaccination.
	Leg problems.	Check water consumption. Check Ca, P, and Vitamin D levels in the diet; use lighting programs to increase bird activity.

Poor Live Performance *(Continued)*.

Issue	Possible Causes	Action
Poor early growth and uniformity.	Nutrition.	Check starter ration — availability, nutritional and physical quality. Check water supply — availability and quality.
	Chick quality.	Investigate any source flock issues. Check hatchery procedures — egg hygiene, storage, incubation conditions, hatch time, transport time, and other environmental conditions.
	Environmental conditions.	Reassess brooding practice. Check temperature and humidity profiles. Check daylength. Check the uniformity of light intensity. Check air quality — CO_2, dust, and minimum ventilation rate.
	Appetite.	Check for poor stimulation of appetite (e.g., below-target crop fill for time post-placement).
	Downtime between flocks.	Ensure downtime between flocks is >10 days.
	Disease.	Seek veterinary advice.

Poor Live Performance *(Continued)*.

Issue	Possible Causes	Action
Poor late growth and uniformity.	Low nutrient intake.	Check feed nutritional and physical quality and formulation. Check feed intake and accessibility. Avoid excessive early growth restriction and overly restrictive lighting schedules.
	Infectious disease.	Take veterinary advice on medication and vaccination.
	Environmental conditions.	Check ventilation rates. Check stocking density. Check house temperatures. Check water and feed availability. Check feeder and drinking space.

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