ROSS
An Aviagen Brand

PARENT STOCK

Pocket Guide

2024

Rearing
0 to 20 Weeks

The Pocket Guide

This Pocket Guide was produced to compliment the Ross® Parent Stock Management Handbook. It should be used for quick and practical reference.

This Pocket Guide is not intended to provide definitive information on every aspect of flock management, but draws attention to important features which, if overlooked, may depress performance.

Performance

This Pocket Guide summarizes best practice management for parent stock that receive first light stimulation after 21 weeks (147 days) of age and achieve 5% production at 25 weeks (175 days) of age. However, poultry production is a global activity and across the world, differing management strategies may need to be adapted for local conditions.

The information within this Pocket Guide cannot wholly protect against performance variations which may occur for a wide variety of reasons. The management techniques covered are considered to be the most appropriate to achieve good performance, consistent with maintaining the health and welfare of the bird.

For further information on the management of Ross parent stock, please contact your local Ross representative or visit the website at **www.aviagen.com**.

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Key Management Timetable

Age	Action
Before chick delivery	All housing and equipment should be cleaned and disinfected and effectiveness of biosecurity operations verified prior to chick placement. **Preheat the house at least 24 hours prior to chick arrival.**
	An air temperature of 30˚C (86˚F), measured at chick height in the chick brooding area.
	A floor temperature of 28-30˚C (82-86˚F).
	Litter temperature of 28-32˚C (82-90˚F)
	A relative humidity (RH) of 60-70%.
	House set-up should be completed prior to chick arrival.
	Ensure good biosecurity.

Age	Action
On chick arrival	Achieve optimum environmental temperature. Establish a minimum ventilation rate. Combine vent temperature measurement with monitoring chick behavior to ensure that temperature is satisfactory. Bulk weigh a sample of chicks. Quickly and carefully place chicks in the brooding area. Do not allow chicks to remain in the chick boxes longer than absolutely necessary.
1 week	Develop appetite from good brooding practices. Ensure adequate access to feed and water, provide good quality feed and maintain optimum temperatures. Provide 23 hours of light and 1 hour of dark for the first 2 days after placement. Light intensity must be uniformly distributed throughout the brooding area. Use crop fill assessment as an indication of appetite development. Monitor bird behavior and adjust house environment as necessary.

Age	Action
1-2 weeks	Achieve target body weight through flock management and body-weight sampling. A bulk weighing of birds is required at 1-2 weeks (7-14 days) of age. Where possible, provide a constant (8 hour) daylength by 10 days of age. In open-sided houses, daylength will depend on the placement date and the natural daylength patterns. Increasing the number of birds weighed or the frequency of weighing (to 2-3 times a week) during the first 2-3 weeks (14-21 days) after placement will be beneficial. If 2-week (14-day) body weights for previous flocks have regularly been below target, a longer daylength can be provided until 3 weeks (21 days) of age to help stimulate feed intake and improve body-weight gain.
2-3 weeks	Start recording individual body weights between 2 and 3 weeks (14 and 21 days) of age.
4 weeks	Ensure adequate feeder space and uniform feed distribution is achieved. Monitor and record body weight weekly. If necessary, adjust daily feed allocation for the male and female populations to achieve any revised body-weight targets and maintain uniformity.

Age	Action
4-9 weeks	Grade males and females. After grading, revise body-weight profiles to ensure that birds achieve target body weights by 9 weeks (63 days).
9 weeks	Re-examine graded population weights in relation to the body-weight target. Combine populations that are of similar weight and feed intake. If populations are not following the target profile, a new target body-weight line should be drawn. For populations that are over the target weight, a new target line should be drawn so that the birds are brought back to target at 15 weeks (105 days). Populations that are under the target should gradually be brought back to target by 15 weeks (105 days).
9-15 weeks	Ensure correct feeding space and uniform feed distribution is achieved. Monitor and record body weight weekly. If necessary, adjust daily feed amounts for the male and female populations to achieve the target or any revised body-weight targets, and maintain uniformity. The main focus during this period is to correctly manage the growth within each graded population. All populations should achieve similar body weights by light stimulation.

Age	Action
15 weeks	Re-examine body weights in relation to target. Underweight birds need to be brought back to target by 21 weeks (147 days). For populations that are over the target weight, a new target line should be drawn parallel to the target. Remove any sexing errors as they are identified. Movement of birds between populations should stop.
15-21 weeks	Ensure correct feeding space and uniform feed distribution is achieved. Achieve correct weekly body-weight gains by ensuring the appropriate feed amounts are given. Begin assessment of pin-bone spacing.
18-21 weeks	Remove remaining sexing errors.

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.

Stockmanship

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

Stockmanship – using the senses to monitor the flock.

1 Sight

Observe behaviors such as bird distribution in the house and number of birds feeding, drinking, preening, mating and using nest boxes. 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 (breast conformation, vent and feather condition). Take notice of air movement across your skin. Is there a draft? What does the temperature of the house feel like?

These observations will help build a picture for each individual flock / house.

Remember, no two flocks or houses are the same!

- Compare this "stock sense" information with actual farm records – are the birds on target?
- Investigate irregularities and develop an action plan to address issues.

The Relationship Between Stockmanship and Bird Welfare

Stock sense, combined with the stockman's knowledge, experience and skills in husbandry will produce a rounded technician who will also have personal qualities such as patience, dedication and empathy when working with the birds. The implementation of the "Three Essentials of Stockmanship" will not only bring the birds as close as possible to the ideal state of "The Five Freedoms of Animal Welfare", it will ensure efficiency and profitability.

The Three Essentials of Stockmanship include:

- Knowledge of animal husbandry.
- Skills in animal husbandry.
- Personal qualities.

SECTION 1

Equipment and Facilities

Objectives

To achieve optimal flock welfare and performance by providing the correct stocking density and feeding and drinking space, as well as provide the optimal lighting program throughout the rearing period.

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Stocking Density

The following table gives the recommended stocking densities during brooding.

Example of increase brooding area.

Age	Birds / m^2 (ft^2 / bird)
1-3 days	40 (0.27)
4-6 days	25 (0.43)
7-9 days	10 (1.08)
10 days	Final stocking density

The range of figures below represents the variation in conditions from tropical (lower densities) to temperate (higher densities) climates, and are intended as a guide.

Prior to 10-21 days of age, progressively increase bird floor space allowances until the levels given in the table below are reached.

Rearing 10-105 days.*

Males (birds / m^2 [ft^2 / bird])	Females (birds / m^2 [ft^2 / bird])
3-4 (2.7-3.6)	4-8 (1.4-2.7)

*In situations where there is a history of coccidiosis, birds should be released to full house at around 3-4 weeks.

If stocking density is increased, then ventilation, feeder and drinker space must also be increased appropriately.

Actual stocking density will depend on:

- Local laws and regulations.
- Climate and season.
- Type, system and quality of housing and equipment, particularly ventilation.
- Quality assurance / certification requirements.

Feeder Management

The following table gives feeder and drinker space from 0-20 weeks (0-140 days).

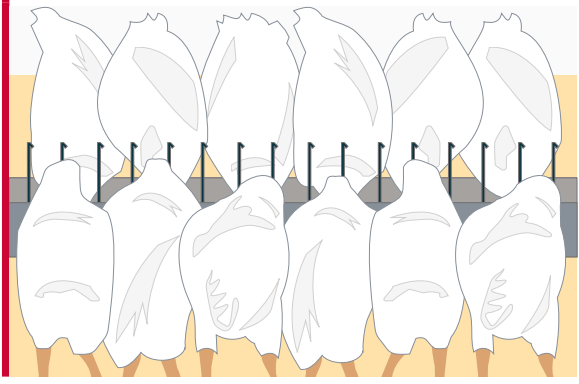
Ensure there is enough feeding space for the number of birds in the house.

Age (days)	Feeding Space			
	Male		Female	
	Track Feeder cm (in)	Pan Feeder cm (in)	Track Feeder cm (in)	Pan Feeder cm (in)
0-35 days	5 (2)	5 (2)	5 (2)	4 (2)
36-70 days	10 (4)	9 (3.5)	10 (4)	8 (3)
71-140 days	15 (6)	11 (4)	15 (6)	10 (4)

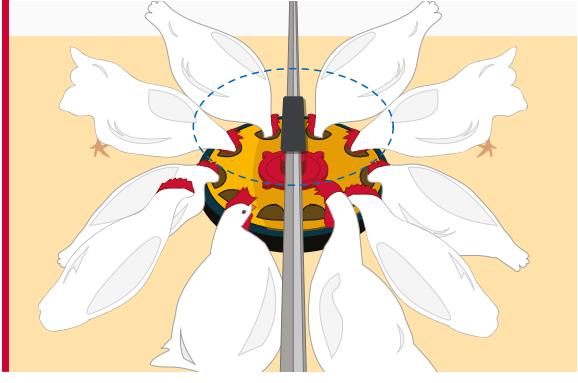
To ensure easy access, feeders should be 1 m (3.3 ft) apart.

The distance between pan feeders within a line (from center to center) should be a minimum of 0.75 m (2.5 ft).

Uniform distribution of females around a track feeder when adequate feeder space is given.



Uniform distribution of males around a pan feeder when adequate feeding space is given.



Floor feeding is an alternative to tracks and pans. This method offers rapid and even distribution of feed over a wide area and can improve flock uniformity, litter condition and leg health.

Spin feeders should be set-up to prevent overlap of feed at walls and pen partitions.

For floor feeding, pen population size should be no more than 1,000-1,500 birds (depending on the pen shape and spinner type).

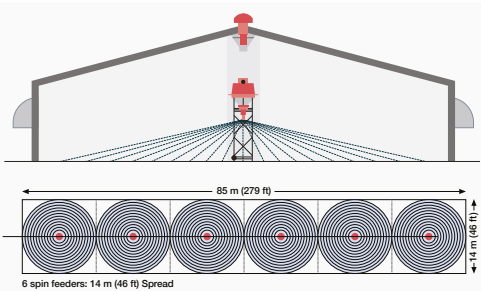
Feed of good physical quality is particularly important with floor feeding.

Use a pellet with 2.5 mm (0.094 in) diameter and 3-4 mm (0.125 in) in length.

Crumb should be fed on feeder trays on the floor until approximately 2 weeks (14 days) of age.

Crumb and pellet should be mixed and fed on the floor / feeder trays for at least 2 days before birds are given 100% pellets at around 16 days of age, when mechanical spin feeding begins.

Floor feeding using either spin feeders or hand broadcasting.



Drinker Management

Recommended drinking space requirements during rear (post brooding).

Type of Drinker	Drinker Space
Bell	1.5 cm (0.6 in)
Nipples	8-12 birds / nipple
Cups	20-30 birds / cup

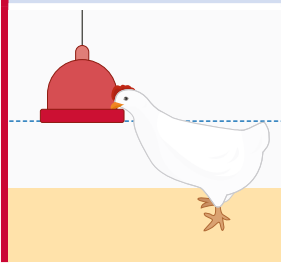
Birds should have continual access to fresh, clean, drinkable water.

Regular cleaning is required to ensure the hygiene of open-sourced drinkers.

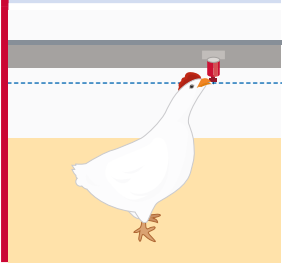
The measurement of water consumption by metering is an essential daily management practice.

Check and adjust drinker height daily.

Correct height of bell drinker.



Correct height of nipple drinker.



At 21°C (70°F) ambient temperature, water intake ratio is, at a minimum, 1.6:1 (water:feed), depending on drinker type.

Water requirement increases by approximately 6.5% per degree centigrade over 21ºC (70ºF).

Water temperature should be at 18-21°C (64-70°F).

Test the water supply regularly for bacteriological and mineral contaminants and take any necessary corrective action.

If bacterial counts are high, where permitted, treatment with chlorination to give 3-5 ppm (at the point furthest from the source) may be required to reduce bacterial load of drinking systems. In regions where chlorination is restricted or prohibited, follow local laws and regulations for the use of approved sanitizers.

Regular assessments of water quality, both at the source and reservoirs, are necessary for monitoring microbial load and mineral content.

Total viable bacterial count is a good quality assurance test. The table below shows the standard operating levels of TVCs and specific pathogens.

Limits per ml of water in main water supply.

	Good	Acceptable	Unacceptable
TVC	0-100	100-300	>301
E.coli	0	0	1
Pseudombnas	0	0	1

If the water analysis results fall within the desired limits, no action is required. However, if the analysis shows TVCs outside the acceptable limits, it will be necessary to clean and sanitize the water system until TVCs are within the ideal range.

Introduction of Perches

It is good management practice to install perches during the rearing period in order to train and stimulate females in nesting behavior (avoidance of floor eggs).

Adhere to local laws, regulations, and Codes of Practice, but as a minimum, there should be sufficient numbers of perches to provide 3 cm (1.2 in) per bird, or to allow 20% of the birds to roost.

Perches should be placed in the rearing pens from the start and birds allowed access from 4 weeks (28 days) of age.

Installing perches during rear is also a useful management tool for training males in situations where water is positioned on the slats.

Perch systems used for training.

Lighting

Lighting Program

The following table gives the recommended lighting program for rearing birds 0-20 weeks (0-140 days) in environmentally-controlled houses.

Age (days)	Daylength* (hours)	Light Intensity†
1	23	80-100 lux (7-9 fc) in brooding area. 10-20 lux (1-2 fc) in the house.
2	23	
3	19	
4	16	
5	14	
6	12	30-60 lux (3-6 fc) in the brooding area. 10-20 lux (1-2 fc) in the house.
7	11	
8	10	
9	9	
10-140	8	10-20 lux (1-2 fc).

* Constant 8-hour daylengths should be reached by 10 days of age. Where there is a history of males in particular being underweight for age, day length can be reduced more slowly to reach 8 hours by 3 weeks (21 days). Males must have access to ad lib feed during this period to maximize use of the extended program; however, avoid residual feed in the litter.

† Average intensity within a house or pen measured at bird-head height. Light intensity should be measured in at least 9 or 10 places and include the corners, under lamps and between lamps. During the dark period (interpreted as night) a light intensity of < 0.4 lux (0.04 fc) should be achieved. Ideally, variation in light intensity within the house should not exceed 10% of the mean.

If reared in open-sided housing, broiler breeders should be allowed to experience whatever changes occur in the natural daylength.

If birds reared in environmental / blackout housing are to be transferred to open-sided housing: Transfer may need to be after 21 weeks (147 days) but before 23 weeks (161 days).

Ensure males and females are synchronized in terms of sexual maturity by rearing them on the same lighting program.

Flicker

Compared to humans, birds have a high flicker fusion rate (the frequency at which it can no longer be perceived) which creates the ability to see fast-moving objects. This aspect of a bird's vision is important when considering lighting because birds will be able to detect flicker (a visible change in brightness) when humans do not. Flicker leads to bird distress, which will eventually lead to decreasing animal welfare and performance.

Uniformity of Light Intensity

Light must be uniformly distributed throughout the house. Frequent changes in contrast between high and low light intensity causes eye discomfort. It can also encourage management issues such as floor eggs. Lights should be evenly distributed throughout the house and be equidistant from the house floor. Reflectors placed on top of the lights can help to improve light distribution. Lights must be kept in good working order.

Lamp types

There are no data to show that one type of lamp induces better performance than any other, and so lamp choice will depend on availability, capital outlay, running costs, and the ability to dim using conventional voltage-reduction equipment.

Advantages and disadvantages of different lamp types.

Lamp Type	Advantages	Disadvantages
Incandescent	Good spectral range. Can be used with dimmer. Inexpensive.	Inefficient. Lasts 700-1,000 hrs. ~15 lumens / watt (tungsten). 25 lumens / watt (halogen). High energy cost.
Fluorescent / Compact Fluorescent	More efficient than incandescent. Use less power. Last longer. Reduce electricity cost compared to incandescent. Relatively inexpensive but more expensive than incandescent.	Difficult to dispose of (contain mercury). Can't be used with dimmer. Loses intensity over time. Issues with flicker. Does not reach maximum intensity immediately when turned on.
Sodium Vapor	Energy efficient. Long life span Consistent color temperature (warm).	Sodium is hazardous. Warm up time is required (5-15 mins). Require a ballast.

Advantages and disadvantages of different lamp types.

Lamp Type	Advantages	Disadvantages
LED	Energy efficient. 200 lumen / watt. Last up to 50,000 hrs. Specific lighting colors can be chosen. Some can be used with a dimmer.	High initial cost. Cheaper lights will not have suitable light spectrum or be suitable for the environment in the poultry house. Flicker can be a problem if not installed correctly.
Halogen	Luminous efficiency. Stable color temperature. Almost no light decay. More efficient than incandescent.	Not ideally suited to dusty environments. Less efficient than LED and fluorescent lamps. More expensive than incandescent lamps. Emits a lot of heat.

Measuring Light

The light meter needs to be appropriate for the lamp type. For example, not all agricultural light meters are accurate for light emitting diode (LED) lights.

SECTION 2

Chick Placement

Objectives

- To provide chicks with a good start, which is essential for the subsequent health, welfare, uniformity and performance of the flock.
- To establish the flock from day-old by developing feeding and drinking behavior, and providing the correct environmental and management conditions to adequately meet the requirements of the chick.

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Farm Preparation for Chick Arrival

Control spread of disease by using single age (all in / all out) housing.

Houses should be cleaned and disinfected and efficacy tested prior to chick arrival.

Be prepared - know what is coming and when.

Plan placements so that chicks from different aged donor flocks can be brooded separately.

Chick holding and transport environment should be monitored closely to prevent the chicks from becoming chilled or over-heated.

Plan areas for grading.

Ensure that the correct conditions are achieved at least 24 hours before chick arrival. This may need to be increased depending on environmental conditions.

At placement, the environmental conditions required are:

- Air temperature of 30°C (86°F) (measured at chick height in the area where feed and water are positioned).
- Floor temperature of 28-30°C (82-86°F).
- Litter temperature of 28-32°C (82-90°F).
- A RH of 60-70%.

Litter material should be spread at a depth of 2-4 cm (0.8-1.5 in).

Chicks should not have to travel more than 1 m (3.3 ft) to access water for the first 24 hours.

Chicks should have unobstructed access to both feed and water.

Position supplementary feeders and drinkers near to the main feeding and drinking systems.

Recommended drinking space requirements during brooding.

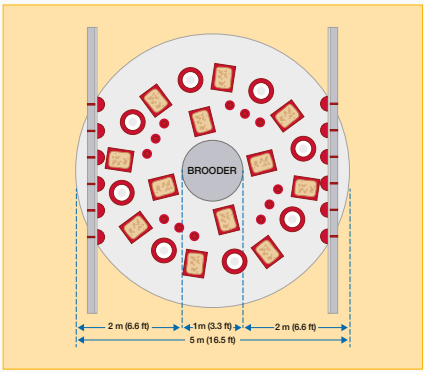
Type of Drinker	Drinker Space
Bell	8 drinkers / 1,000 chicks; 125 chicks / drinker
Nipples	12 birds / nipple
Mini-drinkers or tray	12 mini-drinkers / 1,000 chicks; 9-10 chicks / mini-drinker or tray

Effect of water temperature on water intake.

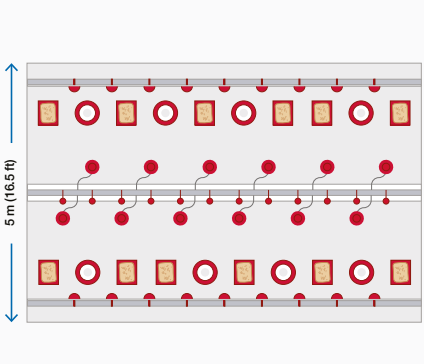
Water Temperature	Water Intake
Less than 5°C (41°F)	Too cold, reduced water consumption
18-21°C (64-70°F)	Ideal
Greater than 30°C (86°F)	Too warm, reduced water consumption
Above 44°C (111°F)	Birds refuse to drink

Flush water lines 1-2 hours prior to chick arrival to ensure water is as fresh as possible.

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



Example of a typical whole-house brooding layout (1,000 chicks).



Brooding Management

Frequently monitor house temperature and RH; adjust to maintain bird comfort.

Replenish feed and water regularly during the first 3 days.

Provide maximum daily feed allocation in small amounts given frequently (i.e., 5-6 times per day) and remove supplementary drinkers completely by 3-4 days of age.

At placement, feed should be a sieved crumb or mini pellet (2 mm [0.06 in] diameter) provided on supplementary feeder trays (1 per 80 chicks) and on paper occupying at least 90% of the brooding area.

For the first 2 days, chicks should be provided with 23 hours light and 1 hour dark.

Expand brooding rings (if used), gradually from 3 days of age and remove brooding rings completely by 10 days. In situations where coccidiosis outbreaks are a concern for the farm, it is beneficial to delay the release of chicks to the full house.

Open-sourced drinkers should be cleaned out regularly.

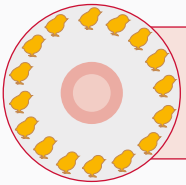
Check feed, water, temperature and RH 1-2 hours after placement and adjust where necessary.

In hot climates, it can be advantageous to flush water lines at least twice a day for the first 3-4 days to keep the water flow high and the water temperature within ideal temperature range.

Monitoring Chick Behavior

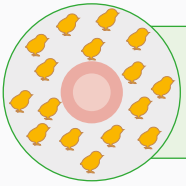
By far the best indicator of correct brooding temperatures is frequent and careful observation of chick behavior.

Bird distribution and behavior under brooders.



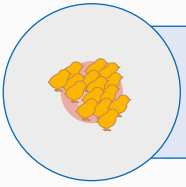
Temperature too high

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



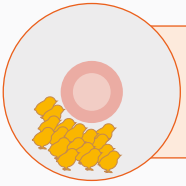
Temperature correct

Chicks evenly spread.
Noise level signifies contentment.



Temperature too low

Chicks crowd to brooder.
Chicks noisy, distress-calling.



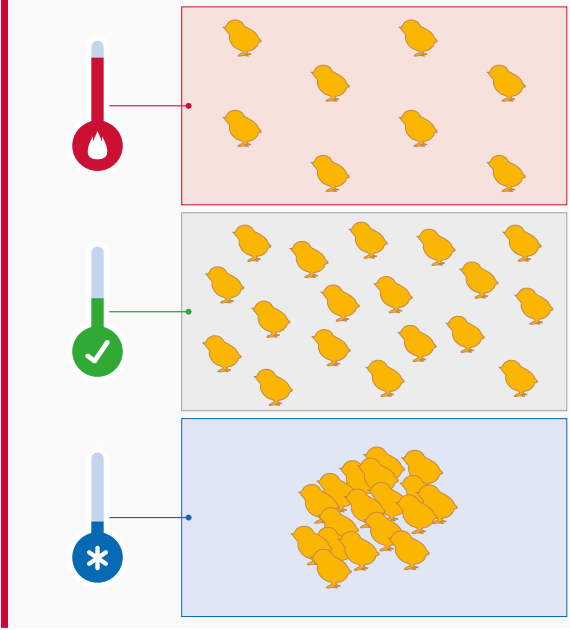
Draft

Chicks huddling in one area of the surround.

Whole-house brooding

Given the opportunity, birds will congregate in areas where the temperature is closest to their requirements.

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

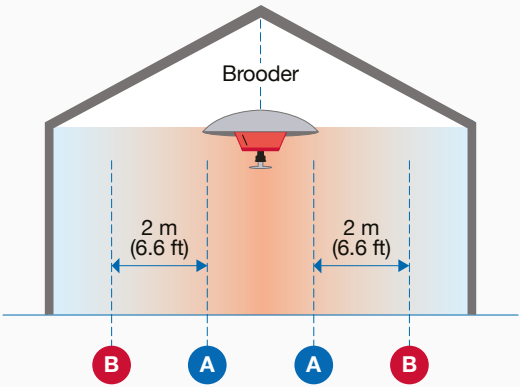


Temperature and Humidity

Recommended temperature guide at bird level at a RH of 60-70%.

Age (days)	Whole-House Brooding Temperature °C (°F)	Spot Brooding	
		Brooder Edge (A) Temperature °C (°F)	Brooder Edge (B) Temperature °C (°F)
Day-old	30 (86.0)	32 (89.6)	29 (84.2)
3	28 (82.4)	30 (86.0)	27 (80.6)
6	27 (80.6)	28 (82.4)	25 (77.0)
9	26 (78.8)	27 (80.6)	25 (77.0)
12	25 (77.0)	26 (76.8)	25 (77.0)
15	24 (75.2)	25 (77.0)	24 (75.2)
18	23 (73.4)	24 (75.2)	24 (75.2)
21	22 (71.6)	23 (73.4)	23 (73.4)
24	21 (69.8)	22 (71.6)	22 (71.6)
27	20 (68.0)	20 (68.0)	20 (68.0)

Spot brooding temperature gradients.



A Brooder edge

B 2 m (6.6 ft) from brooder edge

Dry bulb temperatures required to achieve equivalent temperatures at varying RH. Dry bulb temperatures at the ideal RH are colored green.

	Dry Bulb Temperature at RH%				
	Target	Ideal			
Age (days)	Temperature °C (°F)	40	50	60	70
Day-old	30 (86.0)	36.0 (96.8)	33.2 (91.8)	**30.8 (87.4)**	**29.2 (84.6)**
3	28 (82.4)	33.7 (92.7)	31.2 (88.2)	**28.9 (84.0)**	**27.3 (81.1)**
6	27 (80.6)	32.5 (90.5)	**29.9 (85.8)**	**27.7 (81.9)**	26.0 (78.8)
9	26 (78.8)	31.3 (88.3)	**28.6 (83.5)**	**26.7 (80.1)**	25.0 (77.0)
12	25 (77.0)	30.2 (86.4)	**27.8 (82.0)**	**25.7 (78.3)**	24.0 (75.2)
15	24 (75.2)	29.0 (84.2)	**26.8 (80.2)**	**24.8 (76.6)**	23.0 (73.4)
18	23 (73.4)	27.7 (81.9)	**25.5 (77.9)**	**23.6 (74.5)**	21.9 (71.4)
21	22 (71.6)	26.9 (80.4)	**24.7 (76.5)**	**22.7 (72.9)**	21.3 (70.3)
24	21 (69.8)	25.7 (78.3)	**23.5 (74.3)**	**21.7 (71.1)**	20.2 (68.4)
27	20 (68.0)	24.8 (76.6)	**22.7 (72.9)**	**20.7 (69.3)**	19.3 (66.7)

For a given temperature:

The birds will feel cooler if the RH is low. The birds will feel warmer if RH is high.

If behavior indicates that the chicks are too cold or too hot, the house temperature should be adjusted accordingly.

Monitoring humidity and temperature

Temperature and humidity should be monitored at least twice a day for the first 5 days and then daily thereafter. Measurements of temperature and humidity should be taken at chick level.

Correct location for temperature / humidity sensors.

Chick Start Assessment

Crop Fill

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 the most critical.

PROCEDURE

Crop Fill

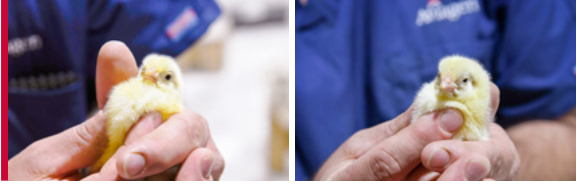
1. **Collect 30-40 chicks at 3-4 different places in the house (or surround where spot brooding is used).**

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

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

   Full but hard with original feed texture felt - chicks have feed but little / no water.

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



Target crop fill assessment guidelines.

Time of Crop Fill Check After Placement	Target Crop Fill (% of Chicks with Full Crops)
2 hours	75
8 hours	>80
12 hours	>85
24 hours	>95
48 hours	100

MANAGEMENT FUNDAMENTAL

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 to resolve this.

Vent Temperature

Measuring vent temperature is a good way of determining if environmental conditions are correct for the chicks. In the first 2 days after hatch, vent temperature should be 39.4 to 40.5°C (103 to 105°F).

PROCEDURE

Vent Temperature

1. **Collect 10 chicks from at least five different locations in the house. Pay particular attention to hot or cold areas of the house (e.g., walls or under brooders).**
2. **Gently pick up the chick and hold it so that the vent is exposed.**
3. **Put the tip of the thermometer onto the bare skin of the vent and record the temperature.**

Taking chick vent temperature.

Sample Weighing at Placement

At placement (day 0), at least three boxes of chicks should be bulk weighed per pen.

The number of live chicks in each box and the weight of the chick box must be known in order to accurately calculate average chick weight.

In addition, it is recommended to individually weigh the chicks in one box per pen at placement to assess chick uniformity and help determine initial early chick management procedures.

PROCEDURE

Bulk Weighing Chicks at Placement

1. "Zero" scales used for weighing.
2. Weigh an empty chick box with the lid on and record the weight.
3. Count and record the number of chicks in each box.
4. Weigh the box with chicks and lid to obtain the total weight.
5. Subtract the box weight from the total weight.
6. Divide the remaining weight by the number of chicks in the box.
7. Plot average weights on a weight chart.

SECTION 3

Monitoring Birds in Rear

Objectives

To meet the requirements of male and female parent stock during each stage of rear, and to prepare them for sexual maturity.

Sample Weighing 44
Assessment of Bird Condition 47

Sample Weighing

Growth and development in a flock are assessed and managed by weighing representative samples of birds and comparing them with target body-weight-for-age.

Sample weighing should start at day-old and continue weekly.

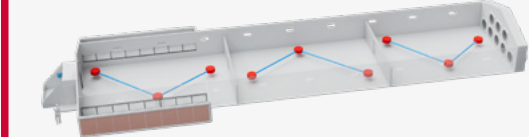
Individual bird weights should be taken from 2-3 weeks (14-21 days) of age for calculation of CV%.

Weigh birds at the same time each week using the same set of scales.

Scale accuracy should be checked regularly.

If sample weighing produces data inconsistent with previous weights or expected gains, weigh a second sample immediately to confirm.

Example of the correct bird sampling points within a house.



PROCEDURE

Bulk Weighing Chicks at 7 and 14 Days

1. Weigh 2% of the population or 50 birds, whichever is greater.
2. Place an empty bulk weighing container onto the scales and set them to “zero”.
3. Place 10-20 birds into the container and record the weight.
4. Empty the chicks from the container back into the main pen population and repeat this step until ALL BIRDS CAUGHT have been weighed.
5. Add all bulk weights together and divide the total weight by the total number of chicks weighed in the pen. Plot this average weight on a weighing chart.

Example of bulk weighing chicks up to 14 days of age.

PROCEDURE

Individual Weighing after 14 Days

1. Suspend the scales in a secure place in the weighing pen, and ensure that they are set to “zero” with a shackle for holding birds firmly attached.
2. Using a catching pen, sample at least 2%, or 50 birds per population, whichever is greater.
3. Birds should be sampled from 3 points within the house, away from doors and walls.
4. Calmly and correctly handle each bird, place it on the shackles, wait until it is still, and record the weight from the scale.
5. Release the bird back into the main pen population and repeat the process until ALL BIRDS CAUGHT have been weighed.
6. Plot the average weight on a weight chart.

Examples of individual bird weighing after 14 days of age.

Assessment of Bird Condition

Handle a representative sample of both males and females weekly during weighing from placement to determine overall flock condition.

It is also good practice to catch and physically assess individual birds while doing a house walk-through.

Assessment of bird physical condition in rear is based primarily on body weight, body condition (breast shape and degree of fleshing) and skeletal size (frame size and shank length).

Monitoring shank length at feeding can give an indication of the uniformity of the flock.

High variability in shank length is an indication of an uneven flock which should be monitored and investigated further (e.g., poor feed distribution, inadequate feeder space, health issues or poor brooding conditions).

Be aware of the degree of fleshing, general health, alertness and activity.

Males should be handled regularly and physical body condition assessed at least weekly during weighing from placement, paying particular attention from 15 weeks (105 days) of age in preparation for sexual maturity.

Female pin-bone spacing should be monitored regularly from 15 to 16 weeks (105 to 112 days) of age up to point of lay. Ideally this should be done every time the house is walked, but at a minimum it should be done weekly.

Scoring system to assess male body condition (fleshing) from 15 weeks.

Male Fleshing Scores

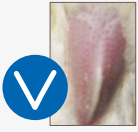
1 Sunken V

Should not be seen within the flock.

Male is emaciated, keel bone is prominent, practically no flesh to measure.

2 Standard V

Keel bone is prominent, but male is carrying some fleshing.



3 Standard U

Chest is getting wider, but still a U shape, practically no keel bone left to be felt.

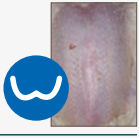
4 Wide U

Chest is getting wider, but still a U shape, practically no keel bone left to be felt.

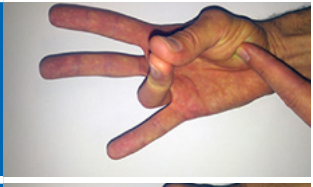
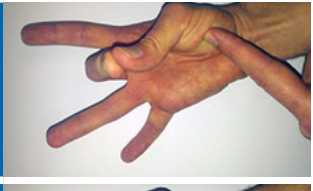
5 Dimpled U

Should not be seen within the flock.

So grossly over-fleshed that the breast dimples, sinking back to the keel.



Example of firmness testing.

Very Firm	
Firm	
Medium-Firm	
Soft	

Pin-Bone Spacing

The spacing of the birds' pin (pubic or pelvic) bones should be measured to determine the state of sexual development of the female.

Changes in pin-bone spacing with age.

Age	Pin-bone spacing*	Approximate distance between pin-bones
84-91 days	Closed	-
119 days	1 finger	1.9-2.5 cm (0.75-1 in)
21 days before first egg	1½ fingers	
10 days before first egg	2-2½ fingers	3.8-4.2 cm (1.5-1.7 in)
Point of lay	3 fingers	5-6 cm (2-2.5 in)

*Pin-bone scoring should always be performed by the same person, if possible, for scoring consistency.

Assessment of pin-bone spacing in females.

Pin-Bone Spacing

PROCEDURE

Monitoring Pin-Bone Spacing

1. Monitor pin-bone spacing regularly from 15-16 weeks (105-112 days) of age up to point of lay.
2. Monitor every time the house is “walked” but as a minimum, once per week during weighing.
3. Ideally, the same person should measure pin-bone spacing from week to week to ensure accurate and consistent measurement and allow for differences in hand size.
4. Select females randomly during the monitoring process and handle with care.
5. Hold the female in one hand and measure spacing by placing your fingers between the pin (pelvic) bones, measuring the distance between them.

6. As a general rule, birds are at the point of lay when the distance between the pin-bones is about 3 fingers (approximately 5-6 cm or 2-2.5 in).

SECTION 4

Grading to Manage Uniformity

Objectives

- To sort the flock into 2 or 3 sub-populations of different average weights (physiological state) so that each group can be managed in a way that will result in good whole flock uniformity at point of lay (POL).

Grading Procedures **54**
Grading using CV% **56**
Grading using Uniformity **60**
Flock Management after Grading **62**

Grading Procedures

Variation within a flock can be measured in two ways:

1. Coefficient of variation (CV%) – CV% measures the variation (spread) of body weights within the flock; the lower the CV%, the less variable the flock is.
2. Uniformity (%) - uniformity (%) measures the evenness of the body weights in the flock within an accepted range of the average body weight (usually accepted as ±10%).

Relationship between CV% and uniformity.

% Uniformity	95	90	85	79	73	68	64	60	56	52	50	47
Coefficient of Variation CV%	5	6	7	8	9	10	11	12	13	14	15	16

Regardless of the actual CV% / uniformity, grading is recommended to ensure optimum rearing and laying performances. Target CV should be ≤ 8% or uniformity ≥ 79% before laying begins.

The actual grading procedure will largely depend on the farm / house design and management practices.

Ideally, house set-up at placement should account for the need to grade the flock with at least 1 pen left empty at placement. In situations where coccidiosis outbreaks are an issue, it is better to have all pens occupied.

Space allocated for both male and female flocks must be capable of being divided into 2 or 3 pens / populations.

After grading, the variation in body weight within the graded populations will have improved.

It is essential that stocking density, feeding and drinking space are maintained in line with recommended guidelines in the graded populations.

The body weights from graded populations should be plotted against targets and the profiles redrawn where necessary to bring birds back on target by 9 weeks (63 days) of age.

Adjustment in feed levels should be based on deviation in body weight from target.

PROCEDURE

Basic Grading

1. Weigh a sample of birds from the population and measure the variation within the flock.
2. Weigh a minimum sample of 2% of the population (or 50 birds, whichever is greater). If more birds than this are caught, they should all be weighed to avoid selective bias.
3. Use flock CV% or uniformity to determine the grading cut-off points.
4. Weigh and divide birds into different pens based on cut-off points.
5. Re-weigh a sample of birds from each pen or population (a minimum of 2% or 50 birds, whichever is greater).
6. Establish the average body weight, CV% or uniformity and number of birds for each pen.

Grading using CV%

Grading cutoffs using CV% (adjustable penning).

Flock Uniformity CV%	Percentage in each population after grading			
	2 or 3-way grade	Light (%)	Normal (%)	Heavy (%)
8-10	2-way grade	20	~ 80 (78-82)	0
10-12	3-way grade	22-25	~ 70 (66-73)	5-9
>12	3-way grade	28-30	~ 58 (55-60)	12-15

CV% > 12

3-way Grade

Adjustable Penning

Percentage of birds in each population

Light	28-30%
Normal	55-60%
Heavy	12-15%

Fixed Penning

Adjust bird numbers according to percentage pen size in each house. E.g., 4 pens each with 25% floor area.

Pen 1	Light 25%
Pen 2	Normal 25%
Pen 3	Normal 25%
Pen 4	Heavy 25%

CV% = 10-12%

3-way Grade

Adjustable Penning

Percentage of birds in each population

Light	22-25%
Normal	66-73%
Heavy	5-9%

Fixed Penning

Adjust bird numbers according to percentage pen size in each house. E.g., 4 pens each with 25% floor area.

Pen 1	Light 25%
Pen 2	Normal 25%
Pen 3	Normal 25%
Pen 4	Heavy 25%

CV% = 8-10%

2-way Grade

Adjustable Penning

Percentage of birds in each population

Light	20% (18-28%)
Normal	80% (78-82%)
Heavy	0%

Fixed Penning

Adjust bird numbers according to percentage pen size in each house. E.g., 4 pens each with 25% floor area.

Pen 1	Light 25%
Pen 2	Normal 25%
Pen 3	Normal 25%
Pen 4	Normal 25%

Grading Using Uniformity

Grading Using CV%

Uniformity	2 or 3-way Grade
68% - 79%	2-way grade
68% or lower	3-way grade

UNIFORMITY 68-79%

2-way Grade

Adjustable Penning

Birds lighter than ±10% of the average body weight = **Light pen**

Birds heavier than ±10% of the average body weight = **Normal pen**

Fixed Penning

Adjust bird numbers according to percentage pen size in each house. E.g., 4 pens each with 25% floor area.

Pen 1	Light 25%
Pen 2	Normal 25%
Pen 3	Normal 25%
Pen 4	Normal 25%

UNIFORMITY 68% or Lower

3-way Grade

Adjustable Penning

Birds lighter than ±10% of the average body weight = **Light pen**
Birds heavier than ±10% of the average body weight = **Normal pen**
Birds heavier than ±10% of the average body weight = **Heavy pen**

Fixed Penning

Adjust bird numbers according to percentage pen size in each house. E.g., 4 pens each with 25% floor area.

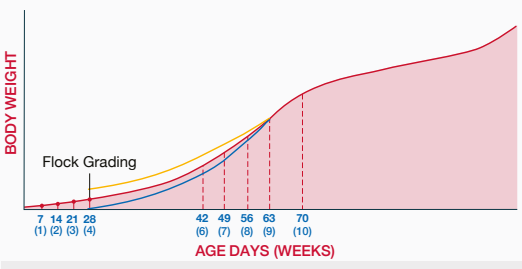
Pen 1	Light 25%
Pen 2	Normal 25%
Pen 3	Normal 25%
Pen 4	Heavy 25%

Flock Management after Grading

(Post 28 Days) Post-Grading Body Weight Management (Up to 63 Days of Age)

After grading, the flock must be managed (body weight monitored weekly and feed allocations adjusted accordingly) so that graded populations achieve target weight in a uniform and coordinated manner within the period that skeletal development occurs (i.e., 9 weeks [63 days] of age).

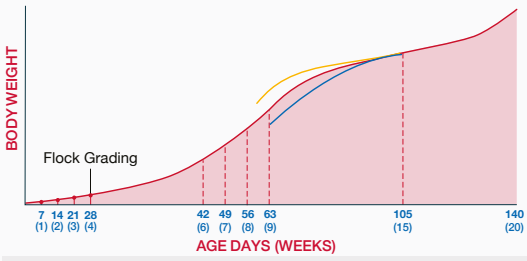
Redrawing of future body-weight targets up to 9 weeks (63 days) of age.



Post 9 weeks (63 Days) Redrawing of Future Body-weight Profiles

At 9 weeks (63 days) of age, the average weight of the population in relation to targets should be re-assessed.

Redrawing of future body-weight targets when average body weight is below, on, or above target at 9 weeks (63 days) of age.



MANAGEMENT FUNDAMENTAL

If population sizes in lay are likely to be larger than they were in rear, it is even more important that management after grading ensures birds achieve a common weight by the age of transfer.

Continue weekly body weight monitoring.

Before mixing any pens, ensure body weight and feed consumption per bird are similar between pens.

Alleviation of Body Weight Problems

If the average body weight differs from target, re-weigh a sample of birds. If the weights are correct, consider the following:

Underweight prior to 15 weeks (105 days):

- Initiate the next feed increase earlier and consider increasing the feed amount if necessary, until body weight is brought gradually back to target.

Overweight prior to 15 weeks (105 days):

- Do not reduce feed levels.
- Reduce the next feed increment (e.g., 2 g per bird [0.44 lb per 100 birds] instead of 4 g per bird [0.88 lb per 100 birds])
- Delay the next feed increase.
- Check to see if the energy level of the diet is higher than expected.

Key areas of incorrect population management post-grading.

Item	Comment	Actions
Stocking Density	Number of birds per m^2 / ft^2 per bird. Bird stocking density must remain equal within each graded pen and follow recommendations.	Adjustable pens - Increase or decrease pen area to maintain the recommended stocking density for age. Fixed pens - Adjust bird numbers within each pen to maintain the recommended stocking density for age.
Light Intensity	Lux / Foot Candle. Light intensity should be uniformly distributed throughout each pen at bird level and avoid shaded areas.	Ensure all light bulbs are set at an equal and uniform distance from the floor. Ensure all bulbs are in good working order, are clean and emit the same level of intensity. Avoid the use of unidirectional light bulbs (old style LED bulbs or spot lights). Avoid the use of low-intensity (high flicker rate) fluorescent tubes.

Key areas of incorrect population management post-grading.

Item	Comment	Actions
Feeding Space	Birds per feeder / cm (in) of feeding space per bird.	Available feeding space should be maintained at recommended levels and adjusted for bird age and number throughout the rearing period and into production.
	Pan feeders (loop or straight line)	Ensure adequate distance between feeder pan centers (minimum of 75 cm [2.5 ft]). Each graded population should have its own dedicated feeding system where possible to allow accurate feed amounts to be given. If not then the whole house population should be fed to the lowest feed amount per bird and any extra feed needed should be added by hand and evenly distributed between all feeders. Follow recommended feeding space per bird throughout rear.

Key areas of incorrect population management post-grading.

Item	Comment	Actions
Feeding Space	Pan feeders (loop or straight line)	Ensure feed allocation settings per pan (feed volumes) are equal, to allow a uniform distribution of feed throughout the house Distribute feed in the dark where possible to allow instant access to feeders when lights are turned back on. Adjust number of pans in adjustable penning if bird numbers change. Ensure feeder height is correct and adjusted for age. Ensure feed is distributed within 3 minutes.
	Track feeders	Ensure recommended feeding space per bird is maintained throughout the rearing period. For adjustable penning, adjust track length for any changes in bird number per pen.

Key areas of incorrect population management post-grading.

Item	Comment	Actions
Feeding Space	Track feeders	Ensure correct depth of feed to allow uniform feed distribution along whole length of track. Each graded population should have its own dedicated feeding system, where possible, to allow accurate feed amounts to be given. If not then the whole house population should be fed to the lowest feed amount per bird and any extra feed needed should be added by hand and evenly distributed along the available track. Ensure feed is distributed within 3 minutes. Distribute feed in the dark where possible to allow instant access to feeders when the lights are turned back on. Ensure feeder height is correct and adjusted for age.

Key areas of incorrect population management post-grading.

Item	Comment	Actions
Feeding Space	Floor / spin / hand feeding	Ensure any spin feeders are calibrated correctly to allow correct amount of feed per bird. Check floor area is covered uniformly with pellets to allow all birds to eat uniformly and that stocking densities within each pen are correct for age of birds. Ensure pellets are of good durability for floor feeding. Ensure litter depth is within recommendations.
Drinker Management	Number of birds per drinker (nipple or bell)	All birds should have unrestricted access to water. Recommended number of birds per drinker should be adhered to throughout the rearing period within each pen. A minimum water-to-feed ratio of 1.6-2.0 should be followed depending on house and external environmental temperatures.

Key areas of incorrect population management post-grading.

Item	Comment	Actions
Drinker Management	Number of birds per drinker (nipple or bell)	If pen sizes need to be adjusted for bird numbers, ensure bell and nipple drinker numbers are adjusted to maintain the correct number birds per drinker. Ensure drinker heights are correct and adjusted for age. Ensure uniform flow rates throughout the pen area.
Ventilation	Calculated for body weight and stocking density	Ensure uniform air flow through all pens by using equal number of inlets open per pen and uniform distribution of inlets throughout house. Use correct number of fans for appropriate air volume calculated for biomass in house and pens.

SECTION 5

15 Weeks to Transfer

Objectives

To ensure a healthy, stable development into maturity with minimal variation in the flock.

Target Weight **73**
Transfer **74**
Final Selection **75**
Sexing Errors **76**

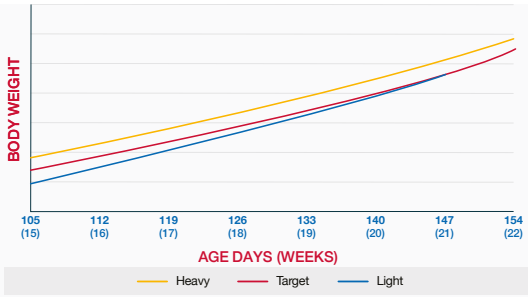
Target Weight

Regular monitoring and recording of body weight and uniformity are essential management tools during this period.

Re-draw target body weight if the flock is 100 g (0.22 lb) or more above target weight (overweight), or 100 g (0.22 lb) or more below target weight (underweight) at 15 weeks (105 days).

Manage birds that are underweight to regain target by light stimulation; for overweight birds, set a new target.

Redrawing of future body-weight targets up to 9 weeks (63 days) of age.



Transfer

Day-old to Depletion Facilities

Where there is a change in feeding system between rear and lay, manage this transfer carefully by ensuring that birds can easily find and get access to the new feeders.

Rear and Move Facilities

For light proof laying facilities transfer should not occur later than 21 weeks (147 days) of age.
For open-sided laying facilities transfer may need to be later than 21 weeks (147 days) depending on the season.
Transfer should never be completed before 18 weeks (126 days) of age or after 23 weeks (161 days) of age, regardless of laying facility type.
Transfer males at least 24 hours before the females to allow the males to find feeders and drinkers.
An additional increase in feed quantity (up to 50%) on the day before and the day of transfer will help compensate for any moving distress.
Do not feed birds on the morning they are due to be moved.
Prior to transfer, flock information should be shared with the laying facility such as numbers of birds, equipment density, CV%, average weight, feed rates, clean-up time, light program and water consumption.

Final Selection

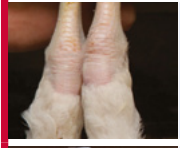
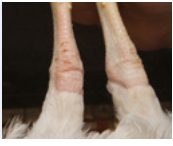
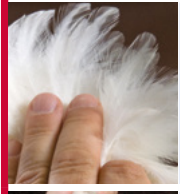
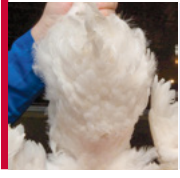
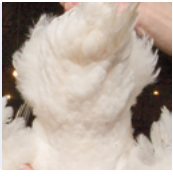
Example of a sexually mature male (on the left) and an immature male (on the right).

Example of a sexually mature female (on the left) and an immature female (on the right).

Sexing Errors

It is good practice to remove sexing errors whenever they are identified during the life of the flock. Ideally, all sexing errors should be removed before mating-up.

Criteria for identifying males and females for the resolution of sexing errors.

Male		Female
	**Comb and Wattles** 15 weeks (105 days) More developed and redder in males.	
	**Hock Joints** 20 weeks (140 days) Thicker and broader in males. Narrower and smoother in females	
	**Feathering Around the Neck** 20 weeks (140 days) Long-fringed, spear-shaped feathers in males. Denser, paddle-shaped feathers in females.	
	**Body Shape** 20 weeks (140 days) Males longer and narrower. Females more compact and broader around pelvis.	

SECTION 6

Ventilation

Objectives

To ensure that good welfare and reproductive performance is achieved by maintaining birds under appropriate, and where possible, optimal environmental conditions.

Ventilation **79**

Ventilation

Open-Sided / Natural Ventilation

Natural ventilation requires continuous 24-hour management.

Vary curtain opening to achieve optimum airflow.

Curtains should be fastened to the sidewalls at the bottom and be opened from the top down to minimize drafts and wind flowing directly onto birds.

If the wind is coming consistently from one side of the building, the curtain on the prevailing side should be opened less than the downwind side to minimize drafts.

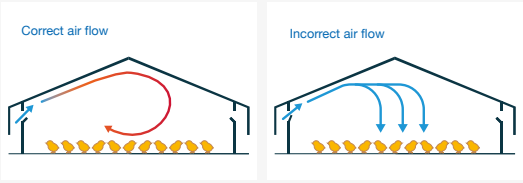
Circulation fans should be used to supplement and enhance temperature control within the house.

In hot weather conditions, several steps can be taken to minimize the impact of high temperatures:

- 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.
- Using tunnel ventilation system with evaporative cooling.

Controlled - Environment Housing

Achieve good airflow and volume.

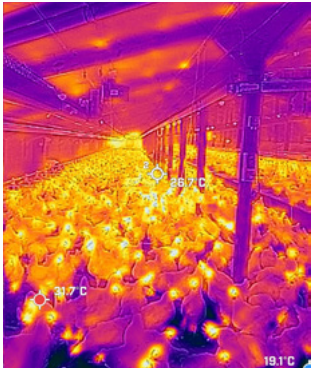


If incoming airflow speed and volume is too low:

- 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 house air speed.

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.

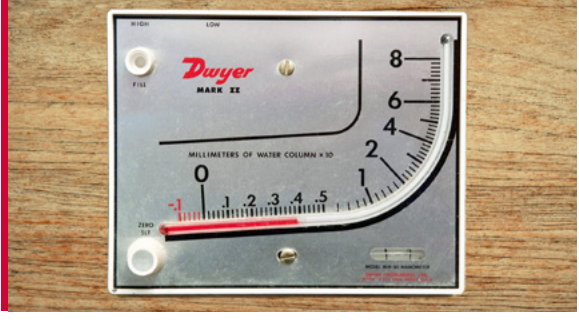
PROCEDURE

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 m² (19,900 ft²) 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 37.5 Pa / 0.15 inches of water column).



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).

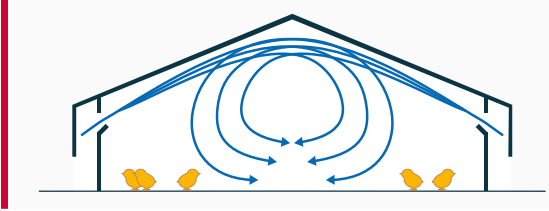
Extraction fans operating on a cycle timer (on / off) draw air into the house through sidewall or ceiling air inlets.

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.



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 89).

Approximate minimum ventilation rates (per bird)

Average Weight kg (lb)	Ventilation Rate* m^3 / hr (ft^3 / hr)
0.05 (0.11)	0.09 (0.05)
0.10 (0.22)	0.15 (0.09)
0.20 (0.44)	0.26 (1.15)
0.30 (0.66)	0.35 (1.21)
0.40 (0.88)	0.43 (1.26)
0.50 (1.10)	0.51 (1.30)
0.60 (1.32)	0.59 (1.35)
0.70 (1.54)	0.66 (0.39)
0.80 (1.76)	0.73 (0.43)
0.90 (1.99)	0.80 (0.47)
1.00 (2.21)	0.86 (0.51)
1.20 (2.65)	0.99 (0.58)
1.40 (3.09)	1.11 (0.65)
1.60 (3.53)	1.23 (0.72)
1.80 (3.97)	1.34 (0.79)
2.00 (4.41)	1.45 (0.86)
2.20 (4.85)	1.56 (0.92)

*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.

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

Air Quality

The main contaminants of air within the house environment are dust, ammonia, carbon dioxide, carbon monoxide and excess water vapor, and 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?

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°F), if RH is >70% or < 50%, particularly during brooding, performance will be affected.

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.

A general guideline for transitional, 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 side wall 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

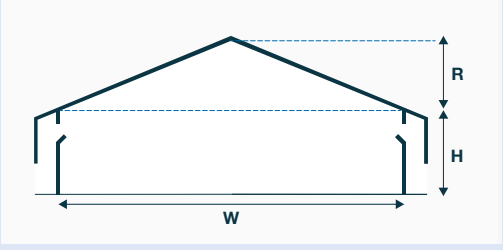
1. **Determine the fan capacity required for a given air speed.**

   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 such as nests in the house, 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.

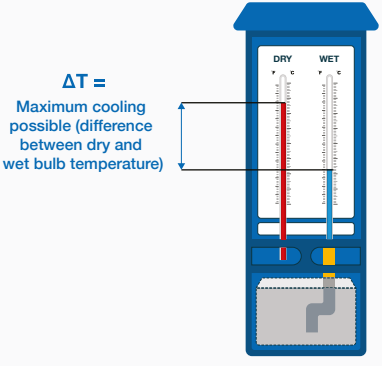
Effectiveness of evaporative cooling systems depends on the RH levels.

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 70-80%, turn off the evaporative cooling system.

Maximum cooling possible during evaporative cooling is about 75% 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.

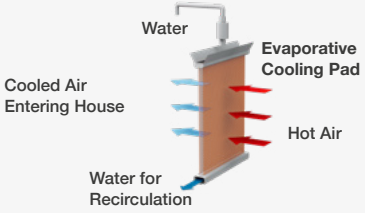
Fogging lines must be placed near air inlets in order to maximize the speed of evaporation, and additional lines should be added throughout the house.

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, resting or scratching dependent on farm routines.
- Are they sitting, huddling together and they are showing signs of being cold?
- Are they holding their wings away from their bodies, showing signs of being too warm?
- Over and above 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).

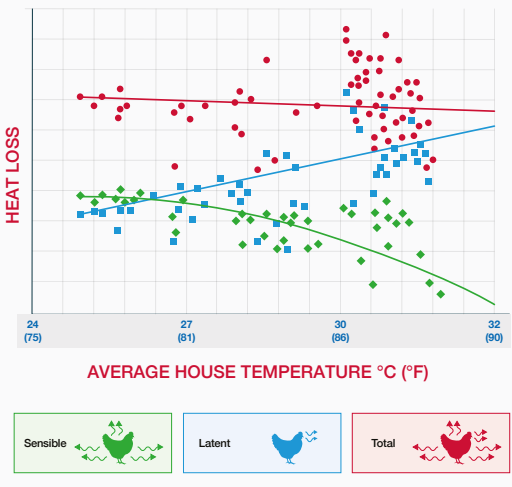
- When air temperature is “cool”, most of the heat loss comes from SHL, because the bird is able to lose warm air from its body to the surrounding cooler air.
- As house temperature increases, the birds ability to lose heat to the air via SHL decreases. This is where the bird will begin to pant to lose 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.



SECTION 7

Nutrition

Objectives

To optimize welfare and reproductive potential (of both males and females) through correct nutritional support for optimal physiological development during the rear period.

Nutrition **98**

Nutrition

Birds respond to daily intakes of nutrients, therefore feeding programs (and feed levels) must relate to dietary nutrient content; especially energy and the nutritional requirements of the bird at a given age.

Diets need to be regularly sampled and the samples analyzed to ensure that the diet is as it should be.

Feeding Programs

Starter Feed

Starter feed should be fed as a sieved crumb or mini pellet, typically given for about 4-6 weeks (28-42 days). When early body-weight targets are not achieved, and management factors are eliminated, adapting or revising the starter strategy (number of diets and nutrient density) may be necessary.

Growing Period

The grower phase is one of the most influential feeding stages due to its length and objective to promote uniformity and optimal female and male body conformation.

The grower feed should be distributed quickly and evenly throughout the house. It is critical to establish strict control on the relationship between energy and digestible lysine, as an excess of lysine will be utilized for breast deposition interfering with body weight and uniformity of body conformation.

Several different feeding strategies can be followed to lead to successful production. A rearing program should consider multiple phases which might include:

Higher nutrient density starter diet to support adequate early development - particularly for males.

Second starter diet to provide a smoother transition to a lower-specification grower diet.

Lower-density grower diet to allow greater control of body-weight development and increased uniformity of feed distribution during this period. Although the diet itself has a reduced concentration of nutrients per kg (lb), the recommended feed intakes and increasing feed consumption over this phase of growth will ensure the required increase in daily nutrient supply.

Developer diet with a lower density help with body-weight control and feed distribution, and smooth the transition to a pre-breeder diet.

Pre-breeder diet to provide consistent amino acid and protein intake while increasing energy and calcium intake for adequate development of reproductive tissue.

Transition to Sexual Maturity

Sufficient amino acids and other nutrients are required for the proper development of reproductive tissues. This can be achieved by implementing the recommended pre-breeder (and developer) diet.

Energy

Recommended feeding levels in the **Ross Parent Stock Performance Objectives** assume a given dietary energy level per kg (lb) for starter, grower and laying flocks. Birds respond to nutrient intake (not nutrient concentration). If diets have feed nutrient levels different from those assumed, then proportional changes in feed allowances must be made.

An example of the adjusting feed volumes for a 2,800 kcal / kg (1,270 kcal / lb) to a 2,700 kcal / kg (1,225 kcal / lb) feed.

METRIC	
Energy intake	= Feed volume x (Energy of current feed ÷ 1,000) = 66 g / bird / day x (2,800 kcal / kg ÷ 1,000) = 184.8 kcal / bird / day
Adjusted feed intake	= Energy intake ÷ Energy of new feed = 184.8 kcal / bird / day ÷ (2,700 kcal / kg ÷ 1,000) = 68.4 / bird / day

IMPERIAL	
Energy intake	= Feed volume x (Energy of current feed ÷ 1,000) = 14.5 lbs / 100 birds x 1,270 kcal / lb = 30,612.8 kcal / 100 birds
Adjusted feed intake	= Energy intake ÷ Energy of new feed = 30,612.8 kcal / 100 birds ÷ 1,225 kcal / lb = 15.1 lbs / 100 birds

Adjustment of energy (feed) intake must be based largely on observation of the birds' responses in body weight, body condition, feather condition, health status, feed clean-up time and egg mass.

Energy contents of successive feeds should not vary widely. Feed changes should be gradual and carefully controlled, especially when changing diets (e.g., transition from starter to grower feed).

Temperature Effect on Energy Requirements

As operating temperature differs from 23°C (73°F), energy intakes should be adjusted pro rata as follows:

Increased by 6 kcal (1.2 kcal / 1°C) per bird per day if temperature is decreased by 5°C (9°F) from 23 to 18°C (73 to 64°F).
Reduced by 7 kcal(1.4 kcal / 1°C) per bird per day if temperature is increased from 23 to 28°C (73 to 82°F).

When temperatures are above 28°C (82°F) the relationship is not as straight forward. The bird's need to dissipate heat results in an increased daily energy requirement. However, this is difficult to achieve practically because of reduced appetite. Therefore, feed composition, feed amount and environmental management should be controlled to reduce heat stress.

Feed Management

Feed deliveries should be scheduled so that feed does not reside in farm feed bins for excessive periods of time (i.e., >10 days). Feed bins should always remain covered and be in good condition to prevent water entry. Feed bags should be stored in a dry, clean, vermin free place, off the floor and inspected for any damage before given to birds. Any feed spills should be cleaned up promptly.

Use a standard weight to check the accuracy of the feed scales daily before use.

A visual assessment of every feed delivery should be made. The feed should be assessed on its physical quality, color, appearance and smell. For mash, check that there is good distribution of raw materials throughout the feed.

A program of monitoring the quality of finished feed is necessary, which should include both feed mill and farm sampling.

Water is an essential ingredient for life and birds should have unlimited access to clean, fresh water at all times.

General rule of thumb is a minimum of 1.6:1 (water:feed) at 21°C (70°F).

SECTION 8

Health and Biosecurity

Objectives

- To achieve hygienic conditions within the poultry house, and to minimize the adverse effects of disease.
- To attain optimum performance and bird welfare, and to provide assurance on food safety issues.

Health and Biosecurity **105**
Health Management **111**

Health and Biosecurity

Preventing Diseases Transmitted by Humans

Minimize the number of visitors and prevent unauthorized access to the farm.

All people entering the farm should follow a biosecurity procedure.

It is recommended to only visit one farm per day.

If visiting multiple farms is unavoidable, visit facilities or houses with the youngest birds first before moving to older birds.

Maintain a record of visitors.

Workers and visitors should wash and sanitize boots and hands when entering and leaving the poultry house.

Only necessary items should be taken into the house and only after they have been properly cleaned and disinfected.

On-farm biosecurity

Preventing Diseases Transmitted by Animals

Place farm on an “all in/all out” placement cycle.
A minimum downtime of 3 weeks (21 days) will reduce contamination on the farm.
Keep all vegetation cut 15 m (49 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.
Keep wild birds and pets out of all buildings and the fenced farm area.
Maintain an effective rodent control program.
Use an integrated pest management 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.

   Spraying with an approved insecticide may also be done 2 weeks (14 days) before depletion.

   A second treatment of insecticide should also occur prior to fumigation.

3. **Remove dust.**

4. **Pre-spray with an approved detergent solution throughout the inside of the house.**

5. **Remove all equipment.**

6. **Remove and dispose of litter.**

7. **Wash using a pressure washer with foam detergent, and rinse with hot water.**

PROCEDURE

Cleaning Water Systems

1. Drain pipes and header tanks.
2. Cleaning the nipple 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 may be done using high levels (140 ppm) of chlorine or per-oxygen compounds.
5. Refill the 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 air locks.
7. Make up header tank to normal operating level with additional sanitizer and solution at appropriate strength. Replace lid and allow disinfectant to remain for a minimum of 4 hours.
8. Drain and rinse with fresh water.

PROCEDURE

Cleaning Water Systems (Continued)

9. Ensure water lines are flushed completely before birds are allowed to drink.
10. Test water quality routinely for bacterial and mineral contamination and take necessary corrective action based on the test results. Take samples from source, storage tank and drinker points.

PROCEDURE

Cleaning Feeding Systems

1. Empty, wash and disinfect all feeding equipment.
2. Empty bulk bins and connecting pipes, and brush out where possible.
3. Clean out and seal all openings.
4. Run auger systems out and ensure no feed is left.
5. Fumigate wherever possible.

Disinfection

Disinfection should not take place until the whole building (including the external area) is thoroughly cleaned and all repairs are completed.

Disinfectants are ineffective in the presence of dirt and organic matter.

Manufacturers' instructions must be followed at all times.

Disinfectant should be applied using either a pressure-washer or backpack sprayer.

Foam disinfectants allow greater contact time.

Heating houses to high temperatures after sealing can enhance disinfection.

If using a selective coccidial treatment, this should only be used by suitably trained staff and should be applied to all clean internal surfaces.

Evaluation of Farm Cleaning and Disinfection Efficacy

Monitor the efficacy and cost of cleaning out and disinfection.

Complete *Salmonella* isolations and total viable bacterial counts (TVC).

Monitoring trends in *Salmonella* / TVCs will allow continuous improvement in farm hygiene and comparisons to different cleaning and disinfection methods to be made.

When cleaning and 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.

Health Management

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 your veterinarian.

Vaccination alone cannot prevent flocks from overwhelming disease challenges and poor management.

Vaccination is most effective when disease challenges are minimized through well designed biosecurity and management programs.

Base vaccination programs on local disease challenges and availability of vaccine.

Properly discard vaccine bottle and vials after use.

Monitor and control worm burden.

Salmonella infection via feed is a threat to flock health. Heat treatment and monitoring of raw materials will minimize the risk of contamination.

Only use antibiotics to treat disease with veterinary supervision.

Keep records and monitor flock health.

Aviagen®

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Every attempt has been made to ensure the accuracy and relevance of the information presented. However, Aviagen accepts no liability for the consequences of using the information for the management of chickens.

For further information on the management of Ross stock, please contact your local Ross representative.