

AVIATECH

TECHNICAL INFORMATION FOR THE BROILER INDUSTRY

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INTRODUCTION

A good hatchery maintenance program is an essential part of maximizing hatchery performance. Maintenance programs minimize the risk of machinery failure and the impact of incorrect machine operation on hatch and chick quality.

Ensuring that maintenance, calibration and routine equipment checks are carried out correctly is important and is assisted by the use of schedules of activity, check lists and keeping good records.

Hatchery maintenance programs not only include the setters and hatchers, but also all ancillary equipment and the structure of the hatchery itself. This Aviagen technical document covers ways to monitor and manage calibration, operation monitoring, cleaning and disinfection, and mechanical repair. However, the main focus of the document is to provide advice on how to set up and manage maintenance programs.

Hatchery Maintenance

Aviagen Technical Team



HATCHERY

BREEDER HUSBANDRY

BROILER HUSBANDRY

ETECHNOLOGY

FEED MILLING

ENVIRONMENTAL MANAGEMENT

POULTRY NUTRITION

VETERINARY MEDICINE




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BASIC PRINCIPLES

When setting up a maintenance program, there are six areas to consider:

1. Who is responsible for maintenance?
2. What maintenance is required?
3. How should the maintenance be done?
4. How frequently should maintenance be carried out?
5. How should performance be monitored?
6. What are the cost and benefits?

1. Who is responsible for maintenance?

To ensure that maintenance programs are carried out effectively it is important to define clearly which member of the hatchery staff should do the work.

2. What maintenance is required?

Maintenance is required on any equipment that can affect the performance of the hatchery (**Figure 1**). This will include setters, hatchers, ventilation and air handling systems, generators, water chillers, water treatment systems and alarm systems. If the hatchery is responsible for egg and chick transportation, the trucks will also need to be included within the maintenance program.

Figure 1: Maintenance and cleaning should be carried out on any equipment that can affect the performance of the hatchery. This includes ancillary equipment such as air handling equipment.



The structure of the building and rooms should not be ignored. A well maintained building will be easier to clean and disinfect and will help ensure that the optimal environmental conditions are achieved.

Producing a list of the equipment that needs to be maintained, recording the equipment identity, frequency of maintenance and who is responsible for maintaining the equipment will ensure an efficient program of maintenance occurs (**Table 1**).



Table 1: Example of a list of hatchery equipment requiring calibration.

Name of Device	Number of Device	Location of Device	Calibration Interval	Person or Department Responsible
Acculab	TDHS1	Egg room	3 months	Egg room supervisor
Acculab	TDHS2	Hatch pull room	3 months	Hatch crew supervisor
A&D SV120	TDHS3	Service room	3 months	Service room supervisor
ACH 1-16	TDH-H-1-16	Hatch room	Prior to use	Maintenance
ACH 1-48	TDH I-1-48	Setter room	Prior to use	Maintenance
Nova-Tech Robots	TDH-B TM 1-4	Service room	Monday & Thursday	Service room employee
Temperature Thermometer	TDH-TP-688	Shop	Yearly	Maintenance
Humidity Thermometer	TDH-HP-616	Shop	Yearly	Maintenance
Autoclave Water Bath	TDH-LA-1	Lab	Yearly	Maintenance
Thermometer 1 Water Bath	TDH-WB T-1	Lab	Quarterly	Lab
Thermometer 2	TDH-WB T-2	Lab	Quarterly	Lab
Temperature Thermometer	TDH-TP-723	Shop	Yearly	Maintenance
Humidity Thermometer	TDH-HP-619	Shop	Yearly	Maintenance
Chick Counter Boxes	TDH CCB-1	Pull room	Monthly	Hatch crew

There may also be local regulations or requirements that will affect the maintenance program, for example health and safety regulations.

3. How should the maintenance be done?

Maintenance procedures should follow manufacturers' instructions. The use of checklists can be of great assistance in ensuring that maintenance is carried out correctly.

4. How frequently should maintenance be carried out?

Manufacturers should provide recommended maintenance intervals for their equipment, and these should be followed as a minimum. In addition to the manufacturers recommended maintenance schedules, there may be a need for more frequent inspections based on a history of equipment failures. Ideally parts should be replaced before they fail; having an appropriate schedule of inspection of equipment for signs of wear or damage will help to achieve this.

To ensure that equipment checks and maintenance are carried out at the correct interval it is helpful to set up checklists for daily and weekly maintenance, as well as a diary of planned work for less frequent maintenance.

An example of a hatchery maintenance program is given in **Appendix 1**. This will need to be adapted to the particular requirements of individual hatcheries.



5. How should performance be monitored?

A critical part of hatchery maintenance is the monitoring of equipment to ensure that performance is within acceptable limits and to identify promptly when machines are beginning to drift away from optimum performance. High incubation temperatures are particularly critical as even a short period (< 30 minutes) of high temperature can have a catastrophic effect on hatchability and chick quality. Key equipment such as setters and hatchers will need to be continuously monitored with alarms.

As a minimum the following should be alarmed:

- Temperature and humidity control of setters and hatchers
- Turning in setters
- Power failure for setters and hatchers

Other areas that should be considered for alarms are:

- Room ventilation systems
- Plenum doors left open
- Water chillers

Ideally, alarms should be operated by a system that is independent of the machine's control system so that a failure of the machine equipment does not result in a failure of the alarm system.

In addition, regular (i.e. several times a day) temperature, humidity, ventilation and turning checks will need to be completed to ensure that these parameters stay within acceptable limits (**Figure 2**).

Figure 2: Check and record the setter and hatcher environment several times during the day.



Equally as important as monitoring the performance of the machine directly is monitoring the eggs and chicks in the setters and hatchers. Monitoring eggshell temperature, egg water loss, chick yield, chick vent temperature and examining unhatched eggs can give important information about the performance of the setters and hatchers. The methodology for carrying out these checks has been described in the Ross Tech “**Investigating Hatchery Practice**” and in the series of “**Hatchery How To**” procedural guides. Both are available on the Aviagen website in the Tech Center or can be obtained from Aviagen.

It is helpful to produce suitable recording forms for all the required maintenance checks. These forms should also indicate what action needs to be taken when a parameter is found to be outside the acceptable limits.

6. What are the cost and benefits?

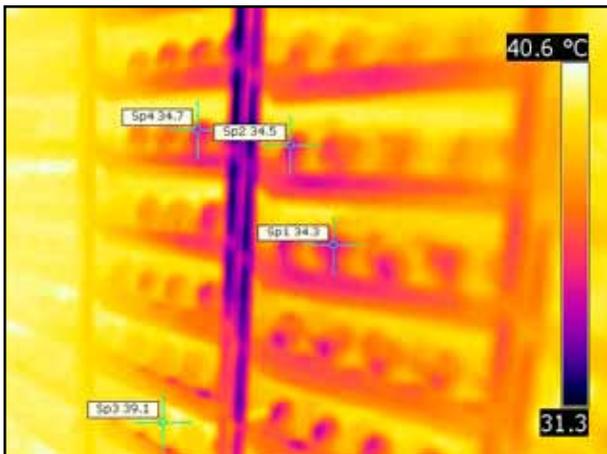
Over time it should be possible to assess the costs and benefits of the maintenance program. This will involve making an assessment of the risk to the business of not maintaining anything and the cost of implementing the maintenance plan.

MAINTENANCE OF SETTERS AND HATCHERS

Good maintenance of setters and hatchers is essential for achieving good hatchery performance. There is a wide range of setters and hatchers being used in hatcheries and each will have its own specific maintenance requirements. However, there are some areas that are common to all machines:

- Make sure all sensors are regularly calibrated (see next section).
- Fix water leaks immediately and make sure eggs are always dry. Water on setter and hatcher floors will cool the floor and can chill the eggs.
- Make sure humidity spray nozzles are not wetting eggs as this will chill the eggs and cause contamination (**Figure 3**). Nozzles need to be regularly cleaned to remove mineral deposits or replaced as recommended by the manufacturer. Water supply pressure to the nozzles is also important for ensuring a fine droplet size.

Figure 3: Thermal camera picture showing wet and cold eggs caused by poorly maintained humidity nozzles.



- Eggs in the setter need to be turned 45 degrees in both directions from vertical (**Figure 4**). If turning is less than 40 degrees this could lead to a loss in hatchability. Turning should be smooth and should not cause jarring of the eggs.

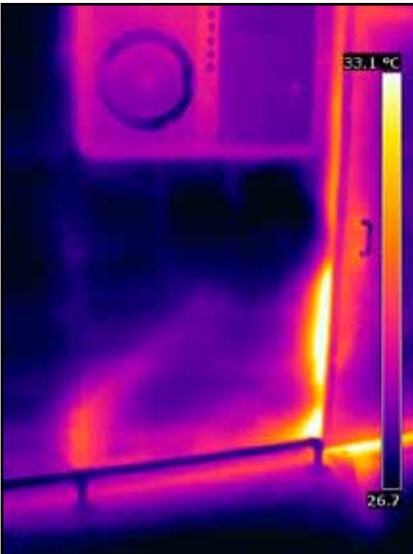


Figure 4: Checking turning angle.



- Make sure door seals and gaskets are not leaking as this will result in cold air entering the machines and local cold spots will develop (**Figure 5**).

Figure 5: Thermal camera image of heat loss through poorly maintained door seal.



- Ventilation fans should be checked to ensure that they turn at the correct rpm (revolutions per minute) as recommended by the manufacturer (**Figure 6**). Where fan belts are used they and the pulleys should be routinely checked for wear and adjustment.



Figure 6: Using a strobe light to check fan speeds.



- Ventilation inlet and outlet dampers should be checked to make sure they operate correctly and that air flow through the setter at the same damper opening is the same in all machines of the same design. Uneven air flows between machines will indicate that the hatchery ventilation system is unbalanced.
- Where wet bulb thermometers are used to control or measure humidity, ensure that the wicks are turned daily and replaced regularly (or after every hatch in a hatcher) and that distilled water is used.

Multi-stage incubators are operated continuously and this can make it difficult to properly maintain, clean and disinfect the machines. It is good practice to plan for each setter to be emptied of eggs at least once per year so that a full maintenance and a thorough cleaning and disinfection can be carried out.

CALIBRATION

All sensors used to control temperature and humidity should be regularly calibrated against a calibration probe to ensure that they do not lose accuracy. The key points to successful calibration are:

- Manufacturers may provide guidelines on how to carry out calibration and these should be followed.
- The calibration probe needs to be of sufficient accuracy, stability and be routinely calibrated against a certificated sensor.
- Set acceptable deviation tolerances for the sensor being calibrated that is appropriate for the sensor type.
- The machine being calibrated should be operating in a stable situation, for example setters and hatchers should not be calibrated straight after an egg set or transfer. In single-stage incubators, it is better to calibrate the setter between 2 – 5 days of incubation.
- Calibration should be carried out in a consistent fashion. That is, the calibration probe should be located in the same location, the eggs at the same stage of incubation, eggs turned in the same direction and ventilation fans turning in the same direction.
- The calibration probe should be positioned as close as possible to the machine sensor (**Figure 7**).



- The frequency that sensors need to be calibrated will depend on the stability of the sensor, but as a minimum calibration should be done once a year. If sensors need to be adjusted every time they are calibrated this would suggest that more frequent calibration is required. If sensors rarely need to be adjusted at each calibration then less frequent calibration may be appropriate. It is also recommended that sensors are calibrated if any repairs are done to the control system or if sensors are replaced.

Calibrating temperature sensors requires an accurate thermometer which has a readability of at least 0.05°C (0.1°F) and high stability (less than 0.05°C [0.1°F] drift per year).

Humidity sensor calibration is most simply done using the calibration thermometer with a wet wick placed on the calibration thermometer probe. Alternatively, an accurate hygrometer can be used.

The calibration of carbon dioxide sensors should be done using an accurate carbon dioxide probe. A cheaper, but less accurate, method is to use carbon dioxide gas tubes.

CHECKING INCUBATORS AND HATCHERS

There are several useful techniques for identifying problems in setters and hatchers in addition to the normal maintenance checks. The eyes and ears of the hatchery staff are important tools in identifying potential problems. For example:

- Heaters and coolers operating at the same time or staying on for long periods of time can indicate:
 - » Sensor calibration problem or sensor failure.
 - » Localized cooling from a water leak, the cooling solenoid is stuck open or cold air entering the machine.
 - » Heater bar stuck on.
 - » Damper stuck (open or closed).
- Condensation on cooling pipes while setters are warming eggs can indicate:
 - » The cooling solenoid is stuck open.
- The hissing sound of water passing through the solenoid when the cooling is off can indicate:
 - » The cooling solenoid is stuck open.
- Water on eggs or floor can indicate:
 - » A water leak.
 - » Too low water pressure to humidity nozzles.
 - » Blocked or partially blocked humidity nozzles.
- Eggs stay turned in the same direction for more than one hour indicates:
 - » Turning mechanism failure.
- Eggs turned at different angles indicates:
 - » Turning mechanism failure.
 - » Turning mechanism not connected correctly.
- If the setter goes through a cycle of heating, cooling and humidifying, possibly with a change in ventilation damper opening it can indicate:
 - » Too much air is passing through the machine.
 - » The temperature control system has cooling and heating set points too close together.
- Noisy fans or fan belts can indicate:
 - » Fan bearings starting to fail.
 - » Worn fan belts.



Some maintenance problems can be difficult to identify from simple inspection alone. For example a single ventilation fan not working can be, to some extent, compensated for by other fans within the machine. Here, the control system would show normal temperature but there would be hot and cold spots within the machine. Checking for hot and cold spots within machines can be done by either installing data loggers or monitoring infertile egg temperatures at different locations within the setter (**Figure 9**).

Figure 9: Checking infertile egg temperatures to look for hot and cold spots within setters.

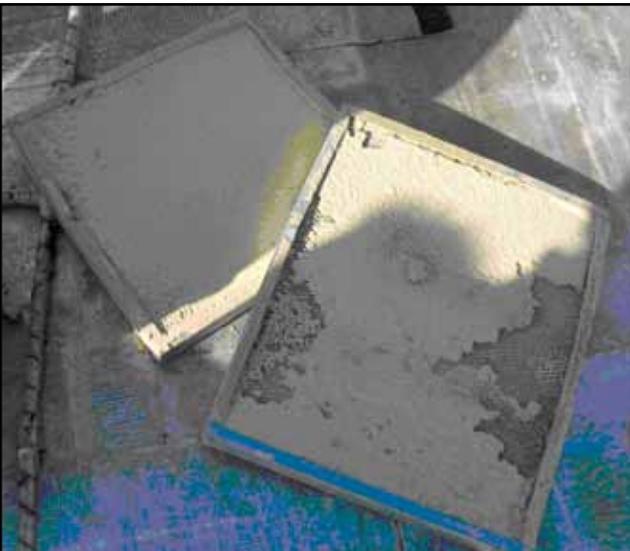


HATCHERY ANCILLARY EQUIPMENT

In addition to the setters and hatchers it is also important to maintain and check the other equipment in the hatchery properly. Manufacturer's recommended maintenance programs should be adhered to. The following are common problem areas in hatcheries.

- Air handling systems:
 - » Filters need be cleaned or replaced regularly as blocked filters will reduce the oxygen supply to the eggs (**Figure 10**).

Figure 10: Air handling system filters that are not regularly cleaned or replaced become blocked and will prevent oxygen entering the hatchery.



- Room humidifiers:
 - » Spray nozzles need to be cleaned or replaced regularly to prevent droplet size becoming too large and floors, machinery and eggs becoming wet.
 - » Humidifiers with water reservoirs need to be regularly emptied and disinfected to prevent microbiological build up.
 - » Disc humidifiers need to be cleaned to remove mineral build up which will result in increased droplet size.
- Cold water supply systems:
 - » Insulate cold water pipes to prevent the water warming up as it passes around the hatchery and condensation forming and dripping on equipment and eggs.
- Room temperature and humidity control sensors (**Figure 11**).
 - » Ensure that sensors are not installed on cold or hot room walls as this can result in an inaccurate measurement of air temperature.
 - » Where wet bulb thermometers are used to measure room humidity, make sure the wick is replaced weekly and distilled water is used.

Figure 11: Checking egg store environment using a temperature and humidity sensor.



- Back-up generators
 - » Ensure that they are tested weekly under load.

CLEANING AND DISINFECTION

An important part of hatchery maintenance is good cleaning and disinfection procedures to prevent the build up of microbiological contamination. Good hatchery design and control of movement between clean and dirty areas within the hatchery will greatly assist in keeping the hatchery clean. It is also easier to clean a hatchery when it is tidy and working areas are kept clear of equipment and material.

There are a large number of detergents and disinfectants to choose from. Ideally, knowledge of the sensitivity of the hatchery's environmental and potentially pathogenic microflora to the active compound in the disinfectant is required. No matter which detergent and disinfection chemicals are chosen, always follow manufacturer's instructions for use. Pay particular attention to the required contact time for the product and the in-use concentration: if the detergent or disinfectant is washed off too soon after application or it is too diluted it will not be effective.

APPENDIX 1: TYPICAL HATCHERY MAINTENANCE PROGRAM

Equipment	Frequency	Actions
Setters and hatchers	Several times a day	<ul style="list-style-type: none"> • Check temperature and humidity reading. • Check ventilation opening. • Check turning.
Egg stores	Several times a day	<ul style="list-style-type: none"> • Check temperature and humidity readings.
Incubator and hatcher rooms	Several times a day	<ul style="list-style-type: none"> • Check temperature and humidity readings. • Check static pressure reading if sensors are fitted.
Setters and hatchers	Daily	<ul style="list-style-type: none"> • Fill up water bottles and turn wicks for wet bulb thermometers if used.
Water chillers	Daily	<ul style="list-style-type: none"> • Check water temperature.
Hatchers	After every hatch	<ul style="list-style-type: none"> • Clean and disinfect. • Visually inspect for damage and wear. • Inspect fan belts for wear. • Check all fans and heater bars are working. • Check humidity sprays are working correctly, i.e., no droplets forming or leaks. Spray nozzles should be removed and cleaned to prevent build-up of deposits. • Check for water leaks from cooling and humidification system. • Check covers to protect sensors during washing are removed after cleaning. • Replace wet bulb wicks.
Hatcher and chick handling rooms	After every hatch	<ul style="list-style-type: none"> • Clean and disinfect. • Clean or replace air filters in air handling unit returns.
Standby generators	Weekly	<ul style="list-style-type: none"> • Test under load.
Room humidifiers	Weekly	<ul style="list-style-type: none"> • Clean nozzles and water reservoirs. • Disinfect water reservoirs.
Hatchery alarms	Weekly	<ul style="list-style-type: none"> • Test all alarms and dial-out systems.



Hatchery Maintenance

Equipment	Frequency	Actions
Setters	Single-stage - after every incubation. Multi-stage - monthly	<ul style="list-style-type: none"> • Clean and disinfect. • Visually inspect for damage and wear. • Inspect fan belts for wear. • Check all fans and heater bars are working. • Check humidity sprays are working correctly, i.e. no droplets forming or leaks. Spray nozzles should be removed and cleaned to prevent build-up of deposits. • Check for water leaks from cooling and humidification system. • Check covers to protect sensors during washing are removed after cleaning. • Replace wet bulb wicks. • Grease fan bearings and turning mechanism cogs. • Check turner mechanism for correct angle and smooth operation. • Inspect ventilation dampers and lubricate linkages.
Hatchery ventilation units	Monthly	<ul style="list-style-type: none"> • Clean or replace air filters. • Clean inside of air ducts.
Water chillers, air conditioning, air compressors, evaporative coolers	Every 3 - 6 months	<ul style="list-style-type: none"> • Maintenance as specified by manufacturer.
Setters	Every 6 - 12 months	<ul style="list-style-type: none"> • Calibrate sensors. • Check infertile egg temperatures.
Hatchers	Every 6 - 12 months	<ul style="list-style-type: none"> • Calibrate sensors.
Setter and hatcher rooms	Every 6 - 12 months	<ul style="list-style-type: none"> • Calibrate static pressure control sensors.
Calibration equipment	Annually	<ul style="list-style-type: none"> • Send for accredited calibration.



