1.0 Introduction

The Sturdy ventilation controller is designed to automatically control indoor air quality including: temperature, relative humidity, carbon dioxide and oxygen in the interior of the vehicle under various exterior and interior conditions. The primary purpose of the system is for the control of indoor air quality while shipping live poultry.

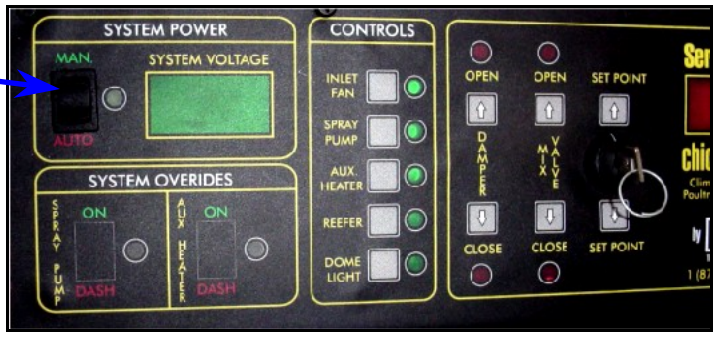
This manual outlines the control system and general procedures to follow during operation.

2.0 General Operation

Control Modes and Overrides

The control has two modes of operation: AUTO and MANUAL. Selection Between modes is done on the Dash Panel (see photo below).

Mode Selection Switch



Control "Dash" Panel

Auto Control

The control should be operated in the 'auto' mode during normal operation between the time when the truck is loaded until unloading. During 'auto' control, the user has no direct control over any of the components of the ventilation system. The user should only have to monitor the sensor feedback on the visual

display. Several conditions require the user to operate the system manually by switching the control to 'manual'. Refer to the 'manual' section below.

Manual Control
Once the system is turned to 'manual', the operation of each of the ventilation components are operated at the choice of the user. Several of the situations where the user will operate the system on 'manual' control are listed as follows:

- preheat
- control malfunction
- electrical malfunction
- washing

System Overrides
With the introduction of the Series 2003 system, there are now two overrides switches located on the dash panel. The first is for the Spray Pump. With the switch in the ON position, the LED will be green, and the Pump will be manually activated. This feature may be used to utilize our evaporative cooling features while running in Auto mode. In the middle position (OFF) the spray pump is disconnected. This feature may be used in the winter under extreme cold conditions if there are fears of freezing lines. In the DASH position, the Spray pump is under the control of the dash panel, as in previous models. In DASH mode, under Manual mode of operation, the Spray pump button will activate the spray pump. The other override switch is for the Auxiliary Heater. This function identically to the Spray pump override, and may be used to disconnect the heater during warm weather months to prevent it from starting for short periods of time.

Preheat
The cargo area should be preheated to target temperature prior to loading. The heater will automatically turn on until the thermostat temperature is reached. The length of time required for preheat will depend on exterior conditions, temperatures and storage of shipping truck.

If the cargo temperature is below target, the time for preheating the cargo area can be decreased by:

- ensuring heater thermostat is set equal to target temperature
- switching the control to 'manual'
- turning on the inlet fan
- fully closing the damper
- fully opening the mixing valve
- switching the control to 'auto' when the cargo area temperature reaches 85°F.

Manual Control

In the event of a control malfunction, turn main switch off, wait 10 seconds, then turn to 'auto' to see if problem has corrected itself. If not, the following procedures should be followed:

- switch the control to 'manual'
- turn on the inlet fan
- adjust the damper and mixing valve to suit conditions (see Table 2 on page 9)
- if heat is required, turn on the auxiliary heater. Turn off when the target temperature is reached.
- turn misters on if the interior relative humidity is less than 50% and/or the temperature is more than 90°F.

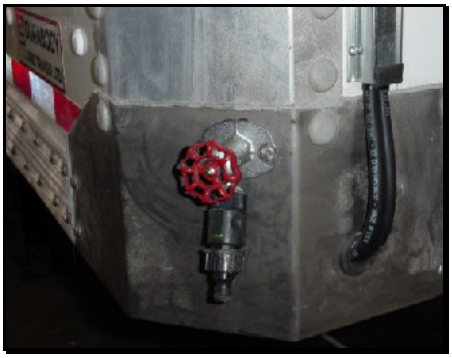
Washing

The controller can be turned to 'off' during washing. If required, to decrease drying time and to prevent freezing, the following components can be manually operated:

- ensure heater thermostat is set equal to target temperature
- turn on the inlet fan
- open the mixing valve

Mist Tank Refill

The mist tank requires filling when empty. Actual time of mist operation will determine the time required to empty the mist tank. The tank should be refilled prior to loading an empty truck. A spigot is located outside of the front of the unit on the passenger side to fill the mist tank. Attach a water hose and fill the tank. Water will flow out of an overflow hose (and onto the ground) when the tank is full. Additionally, there is a cap on the tank to permit the addition of ice to the water if required.



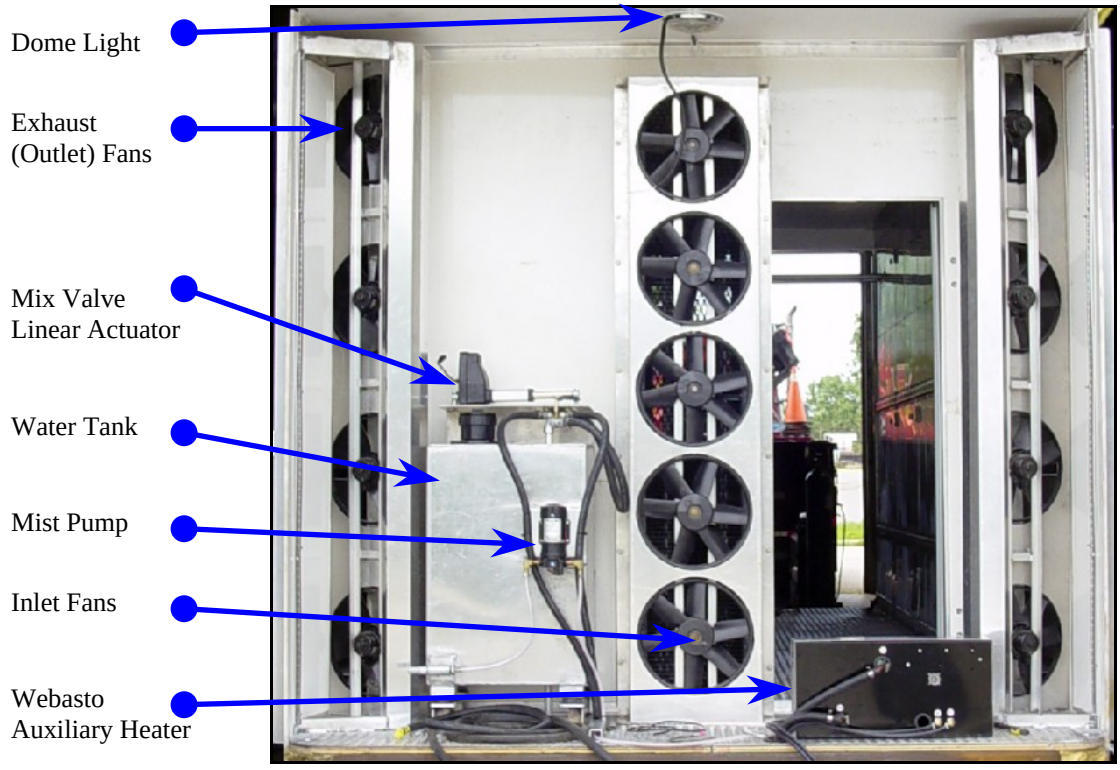
Mist Tank refill Spigot

Mist Tank located inside control compartment.

3.0 Control Logic

The controller operates by a series of conditions dependent on feedback from positioning of components, sensor readings, thermostat setting, and target set points. The controller will adjust system components as required to satisfy the set points.

4.0 Controller Components



Control compartment cross section.

Inlet Fans

The inlet fans provide the required airflow for ventilation. There are intake fans located at the front centre of the cargo area and exhaust fans located at the front along the sides. The intake fans blow air down the centre along the length of the cargo area and the exhaust fans suck air from the sides of the cargo area. The 'INLET FAN' switch controls the operation of the intake fans only.

Mist Pump

The mist pump provides pressure to operate the misters. Misters are used for two purposes: relative humidity control and evaporative cooling. Mist nozzles are located in front of the intake fans. There are 4 mist nozzles each rated at 1.5 gal/hr for a total of 6 gal/hr. The fresh water holding tank for mist water is 42 U.S. gallons. The holding tank capacity will provide continuous spraying for approximately 7 hours.

Auxiliary Heater

The auxiliary heater is the Webasto heater located on the floor in the control compartment. This heater is used to boost the temperature of the heating fluid coming from the truck. The auxiliary heater is diesel fired and has an auxiliary pump to increase fluid flow. Note: the pump will operate for 1 or 2 minutes after the heater shuts down in order to cool the heater.

Dome Lights

Four dome lights are located in the cargo and control areas of the truck for lighting. The lights can be turned on during loading/unloading, maintenance, etc.. The dome light switch also controls a light located inside the electrical panel.

Damper

The damper is the top/front intake baffle door which regulates the amount of fresh air allowed into the cargo area. Side baffle doors are connected to the top/front by rods so they open and close at the same time. The side doors regulate the amount of exhaust from the cargo area. The damper is operated by an actuator. As the damper opens, more fresh air is brought into the cargo area and more air from the cargo area is exhausted to the outside. As the damper closes, less fresh air is brought into the cargo area and more air from the cargo area is re-circulated. When the control is on 'auto' the damper will not close less than a minimum specified setting (ie., 10%) to ensure oxygen requirements are maintained. When operating in Manual Mode, DO NOT under any circumstances operate the vehicle with the damper closed below 10% when the box contains chicks.

Damper – exterior view

Damper with actuator – interior view

Mixing Valve

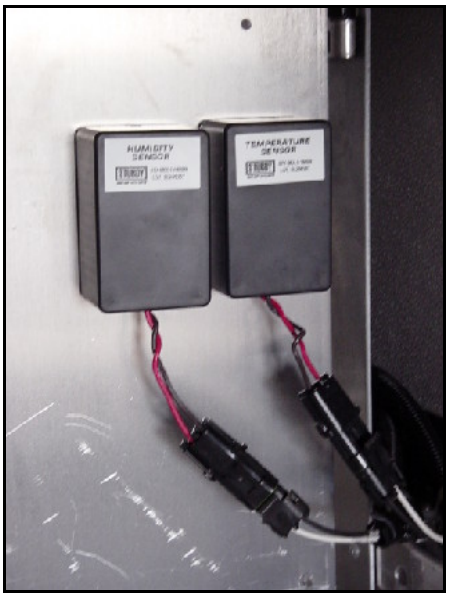
The mixing valve regulates the amount of heat that can enter the cargo area from the heater. If heat is required in the cargo area, the mixing valve will open to allow heated fluid from the heater to enter the radiator of the cargo area. The mixing valve position is operated by an actuator.

Sensors

Four environmental sensors are installed for monitoring and control.

- TEMP.1 - is a temperature sensor located near the front of the cargo area (passenger side).
- TEMP.2 - is a temperature sensor located near the middle of the cargo area (passenger side).
- TEMP.3 - is a temperature sensor located near the back of the cargo area (passenger side).
- OUT.TEMP - is a temperature sensor located outside of the front damper (passenger side).
- HUMIDITY - is a relative humidity sensor located just above ‘TEMP.2'.

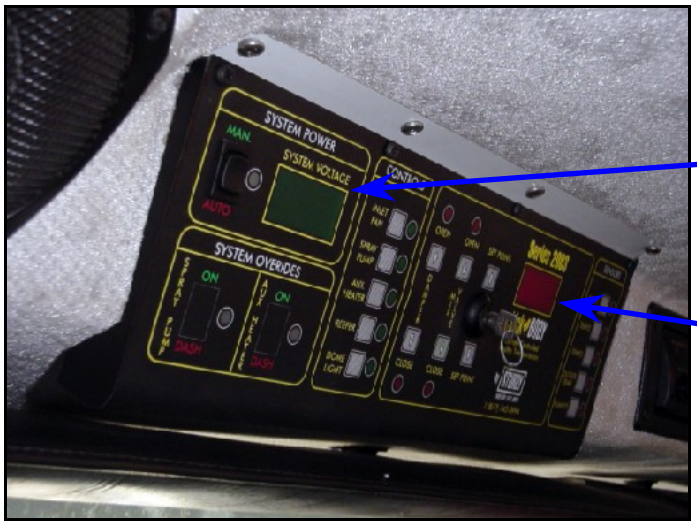
Exterior mounted Temperature sensor (located on the front of the body, beside the damper door)



Interior mounted sensors are located on the access doors on the passenger side of the vehicle.

Displays

Dash Panel (LED Display) – The Series 2003 dash panel is equipped with two LED displays. The first (green), is a voltmeter, that will provide feedback to the operator of system voltage to ensure maximum operation of the system, and to assist in troubleshooting. The second (red) display shows the settings or readouts of each of the control components and sensors. The position of the damper and mixing valve (from 0 to 100% open) are also shown on the display. If this display shows and '8' or 'Lo', this indicates a low voltage situation. The dash panel requires a minimum of 10.5 volts to start the system, and 13 plus volts to get maximum performance from the fans.



Control "Dash" Panel

Fuses – This systems uses standard automotive relays and ATO style fuses for safety. All fuses are located in the Electrical Panel (located in the truck cab, between the seats). Under no circumstances change the value of any fuses in the panel. If a fuses repeatedly is blowing, contact Sturdy Truck Body for further technical advice. Changing values of fuses will result in the damaging of the Dash Panel, or other electrically sensitive components, and may void warranty on these items.

Fuses and control relays are located inside the Electrical Panel. This panel is in the cab of the truck.

5.0 Troubleshooting

Several problems have been listed that may occur during normal operation of the shipping truck ventilation system and have been included in the following table. It is generally recommended to first check if the problem is control related by switching to 'Manual' to determine if ventilation components will operate outside of the controller. If a voltage problem exists, however, some components may operate outside of the controller but not operate with the controller. Contact Sturdy Truck Body technical support for further details.

Table 1: Troubleshooting

#	Problem	Possible Cause	Remedy & Explanation
1	One or more fans stop working.	- fuse blown. - low voltage to control/fans.	Switch to 'Manual' to determine if system operates outside of controller. Check fuses and replace if necessary. Check voltage meter and locate problem of low voltage and/or charge batteries.
2	Temperature in cargo area below or above target but system does not appear operational or to move toward target.	a) low voltage to controller b) controller computer stalled.	a) Switch to 'Manual' to determine if system operates outside of controller. Check voltage meter and locate problem of low voltage and/or charge batteries. b) Switch controller "OFF" for 10 seconds then turn on again.
3	Temperature in cargo is below or above target but misters not working.	- mist water holding tank is empty. - mist nozzles clogged. - mist pump not operating. - fuse blown.	Check mist tank and fill if necessary. Check nozzles for dirt and clean if required. Check fuse for mist pump and replace if needed. Switch to 'Manual' to determine if pump is operational outside of control.
4	Temperature below target, damper is closed to minimum, & mix valve fully open but aux. heater not working.	- fuse is blown. - low voltage.	Switch to 'Manual' to determine if heater is operational outside of control. Heater must have a minimum voltage of 10.5V in order to maintain operation.
5	Ventilation components not responding to control.	- low voltage - fuses blown	The controller must have a minimum of 10.5V in order to maintain operation. Switch to 'OFF' then 'Auto' to reset. Replace fuses if blown.
6	The number '8' or 'Lo' displays on the digital readout and display doesn't change when buttons are pushed.	- low voltage	a) Switch to 'Off' b) Start truck and charge batteries c) Switch to 'Manual' and/or 'Auto' and ensure all components are functioning properly.
7	The number '0' displays on the readout for target temperature, and it will not change.	- The system has internally reset the programming.	- turn key to set target temperature, and press the 'up' and down' at the same time.

Table 2: Manual Damper and Mix Valve Control
Should you need to manually run the system, use the below parameters to set the Damper and Mix Valve.

#	Outside Environmental Conditions	Damper Setting	Mix Valve Setting
1	Outside Temperature is at target temperature or higher.	100%	0%
2	Outside Temperature is 20°F below target temperature	50%	50%
3	Outside Temperature is more than 20°F below target temperature.	10%	100%

6.0 Daily Check List

Table 3: User Daily Checklist

#	Description	Complete
1	Ensure body heating coil is clean. (inspect from both sides)	
2	Fill mist tank.	
3	Fill truck tank.	
4	Check operation of inlet fans.	
5	Check operation of mist pump.	
6	Check operation of heater.	
7	Check operation of damper.	
8	Check operation of mix valve.	
9	Preheat cargo area minimum 1 hour prior to loading depending on outside temperature. Make sure cargo area temperature is at target prior to loading.	
10	Switch to 'AUTO' once loading is complete.	
11	Check and record temperature and humidity sensor readings.	
12	Check and record voltage meter reading.	
13	Check tailgate operation (if applicable) and follow maintenance instructions in manual provided	
14		
15		
16		
17		

Inspected By: Date:

7.0 Preventive Maintenance

Every Two Weeks

- start heater with mixing valve fully open and let it run for 15 minutes
- check battery fluid
- check chick body charging system and replace alternator as necessary (see detailed instructions section 8.0)

Every 3 Months

- replace any fan motors that draw more than 13 amps after running for one minute

Every 12 Months

- replace antifreeze as recommended by chassis manufacturer
- check electrical panel fans

8.0 Chick Body Charging System Check

Equipment Required

- volt meter
- clamp style amp meter
- hydrometer

Expected Alternator Output @ 1000 engine r.p.m.

- Amps cold = 215 amps
  hot = 190 amps
- Volts no load = 14.9 volts
  under load = 14.0 volts

To Test Amps

- must have all truck and body systems turned on
- must test at output cables at alternator
- add output from both cables

To Test Volts

- no load => engine running but nothing turned on
- under load => engine running with all truck and body systems turned on

To Test Batteries

- Use hydrometer with truck turned off
- Must test each cell of each battery

Notes

- voltage tested at equipment (e.g. fans, etc), should be about 13 volts
- a bad battery will cause alternator voltage output to drop