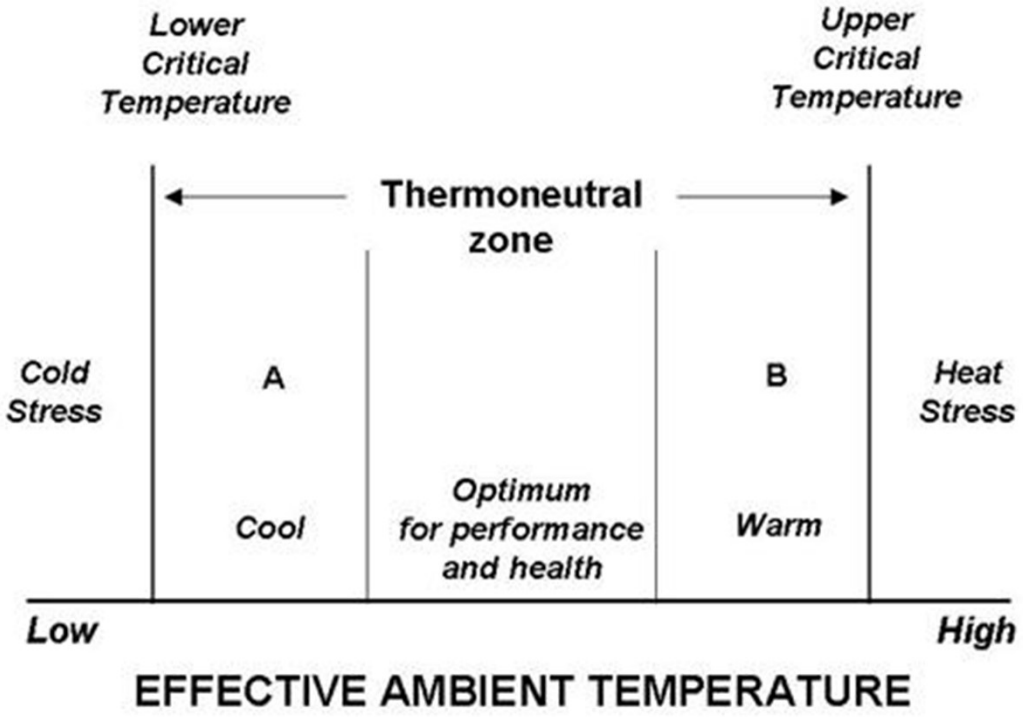
Ventilation Basics

Presented by Derrick Ament

Temperature Stress

Thermoneutral Zone

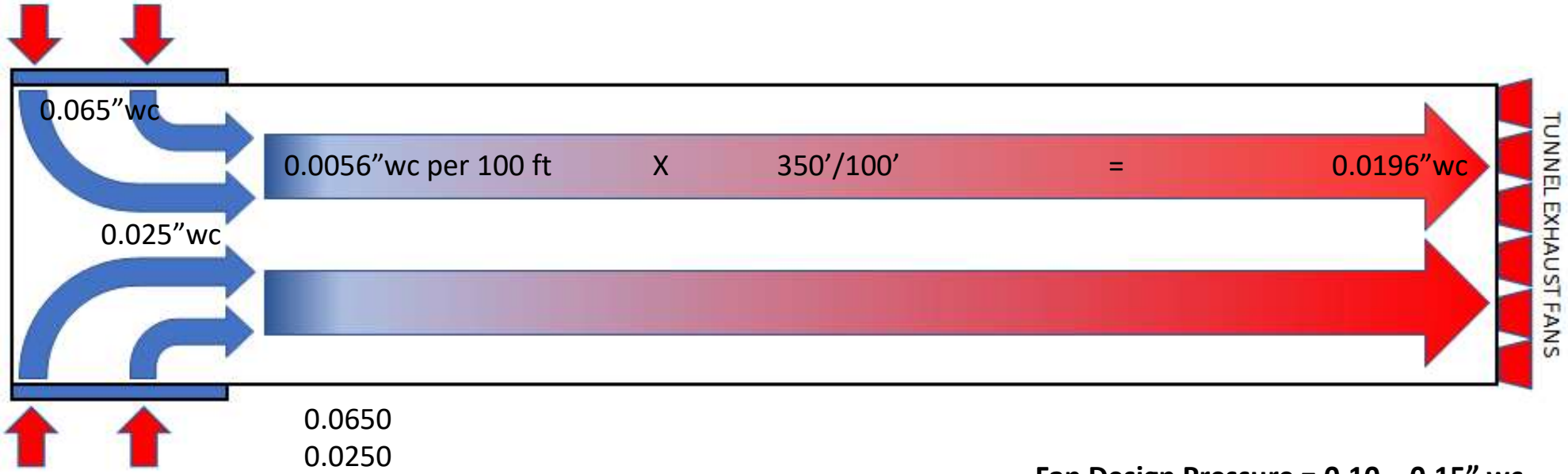


Static Pressure

- Static pressure is the work/energy to move the air from one place to another
- Static pressure is cumulative
- Static difference between the attic or plenum verse the bird area will affect the air speed through the inlets
- Total static the fans are seeing affects how much air the given fan will move

Static Pressure (in.H2O)	Airflow (cfm)	rpm	Volts	Amps	Watts	cfm/Watt	Static Pressure (Pa)	Airflow (m^3/hr.)
0.00	**31800**	543	230.0	5.99	1365	**23.3**	0	54100
0.05	**30500**	542	229.7	6.28	1425	**21.4**	12	51700
0.10	**29000**	541	229.8	6.53	1481	**19.6**	25	49300
0.15	**27100**	540	230.2	6.75	1532	**17.7**	37	46000
0.20	**24900**	539	230.2	6.91	1568	**15.9**	50	42300
0.25	**22200**	538	230.2	7.05	1599	**13.9**	62	37700
0.30	**19100**	538	230.6	7.09	1611	**11.9**	75	32500

Total Pressure = Fan Pressure



0.0650
0.0250
\+ 0.0196
0.1096 ---> FAN PRESSURE: 0.1096”wc

Fan Design Pressure = 0.10 – 0.15” wc

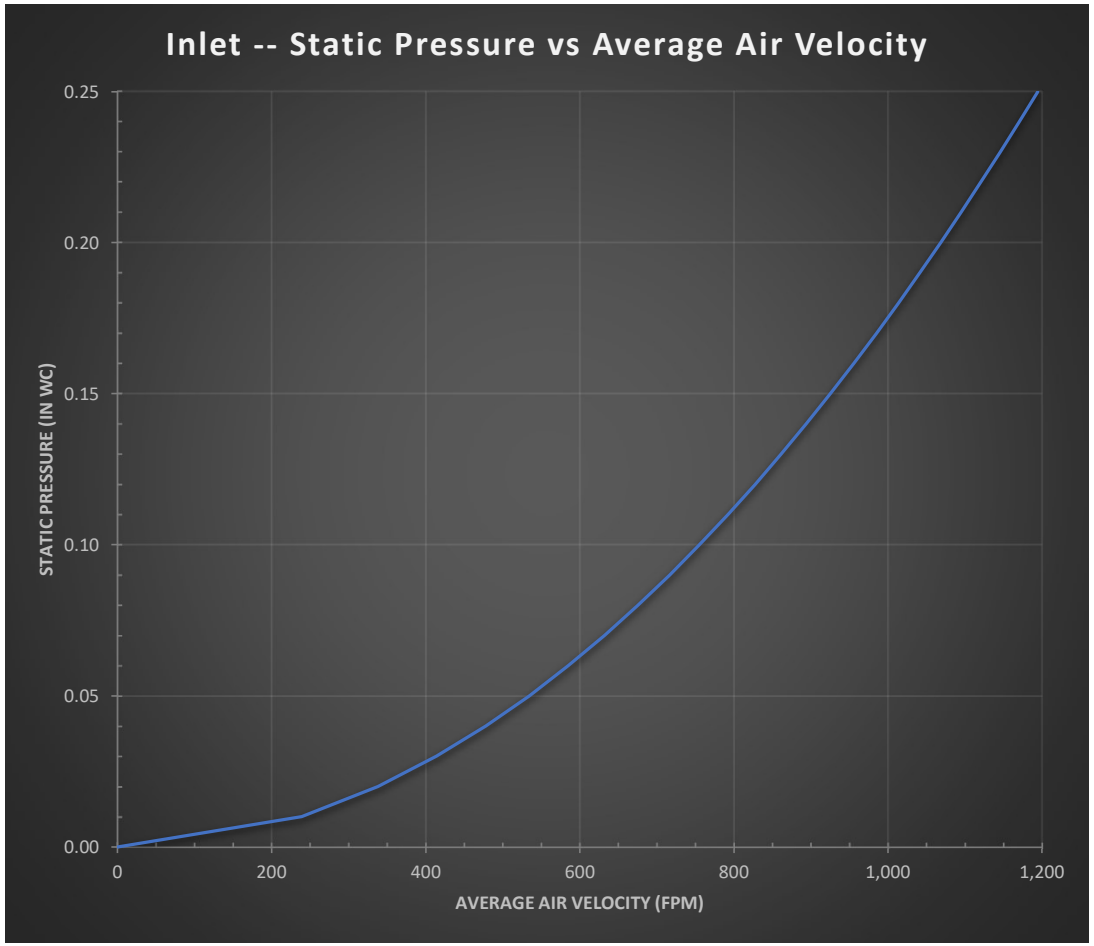
CFM vs Air Speed

- Ventilation rates for barns are either based on CFM/Bird at different levels of ventilation or for full ventilation the air speed (normally used in floor tunnel barns)
- Air Speed is relatively easy to measure then CFM can be calculated using Air Speed

Average Velocity

Depends on…

- Inlet Opening Area
- Static Pressure
- Ventilation Flow Rate



Velocity & Static Pressure for Barn Widths

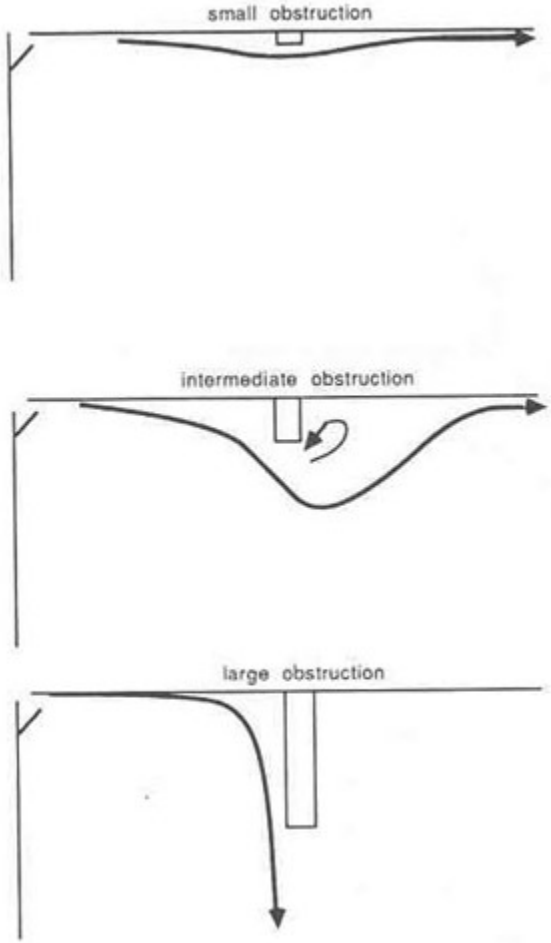
Air flowing along the ceiling travels further

House Width		Static Pressure		Average Air Speed		Air Throw	
m	ft	pa	in wc	mps	fpm	m	ft
10	32	20	0.08	3.4	676	5.0	16
12	40	25	0.10	3.9	755	6.0	20
15	50	31	0.12	4.3	828	7.5	25
18	60	37	0.15	4.7	925	9.0	30
21	70	43	0.17	5.0	985	10.5	35
24	80	49	0.20	5.4	1068	12.0	40

Always use a smoke test to ensure that the incoming air reaches the center of the house.

Obstructions

- Unobstructed air flow

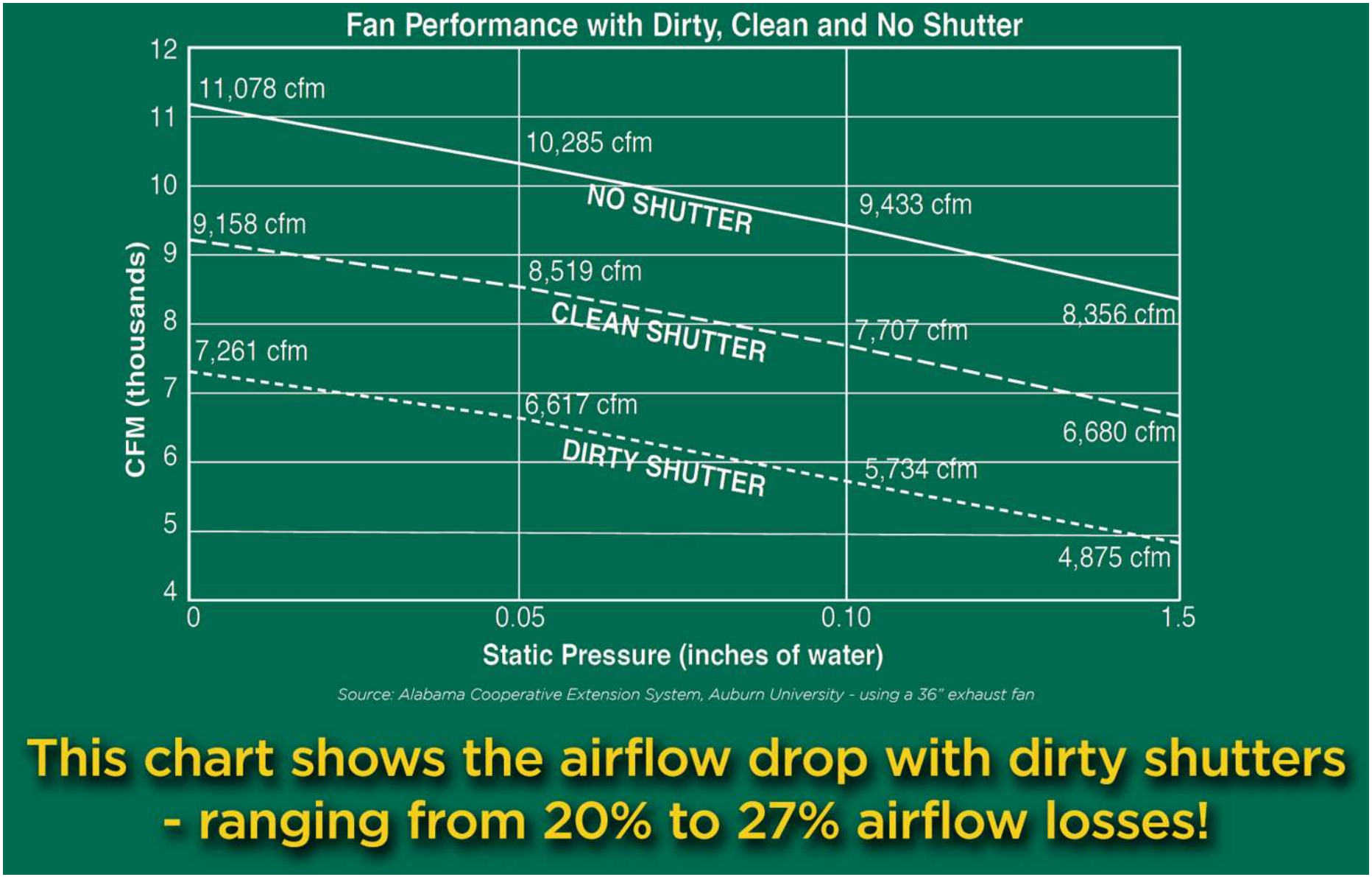


Maintenance – Fans/Inlet

- Belts/Pulleys, Shutters/Wire Guards, Bearing, Motors
  - Replace regularly, especially when fans RPM's drop
- Clean light trap – inlets and fans (shutters, wire guards, etc)
- Check electrical components

OK

BAD



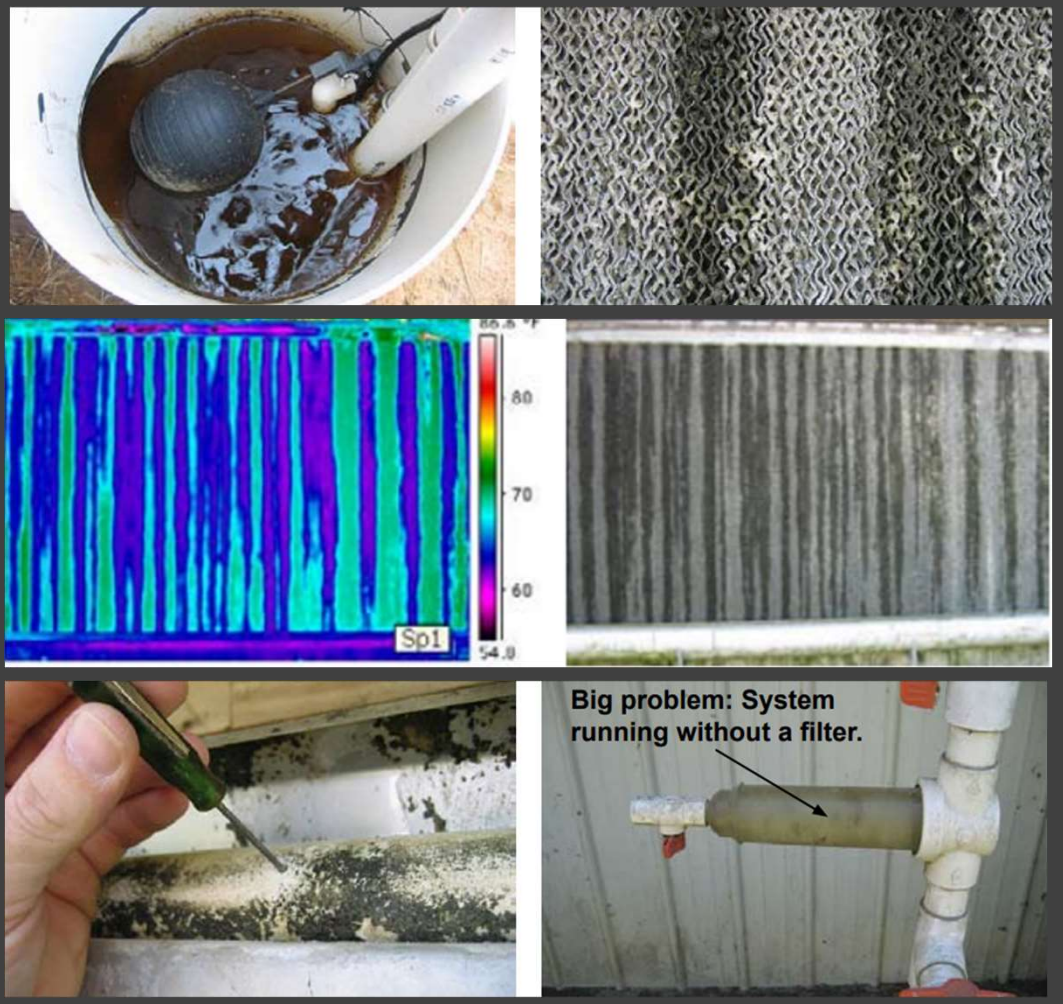
Source: Alabama Cooperative Extension System, Auburn University - using a 36" exhaust fan

This chart shows the airflow drop with dirty shutters - ranging from 20% to 27% airflow losses!

Maintenance – Cool Pads

- Clean water reservoir/trough
- If you have dry spots on the pad dry air is going through the pad
- Clogged pad is decreasing air flow

- Verify water is coming out all of the holes on the header
  - Sidewall Cool pads pump should be on the end towards the tunnel fans
- Filters good idea, they need to be checked/maintained



Tools for maintaining/checking your system.

Manometer – To Check Static Pressure

Wind Meter - Necessary to monitor wind speed to make sure fans are performing optimally. Can also measure temperature and humidity.

Photo Tachometer - Helpful to measure fan RPM's to monitor fan performance.

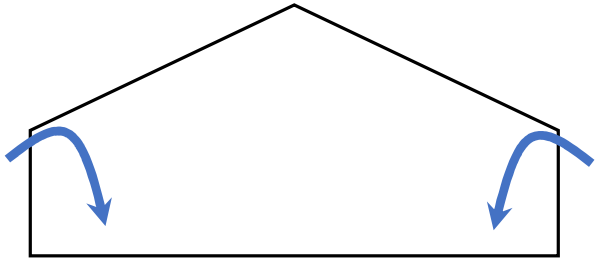
Winter Ventilation Basics

- Getting fresh air to the birds
- Getting rid of moisture
- Maintaining temperature
- Minimizing/Eliminating dead spots

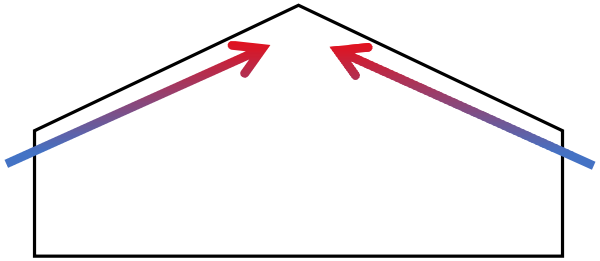
- Cage-Free getting air across the floors
- Make sure light trap is cleaned regularly

Winter Ventilation Basics

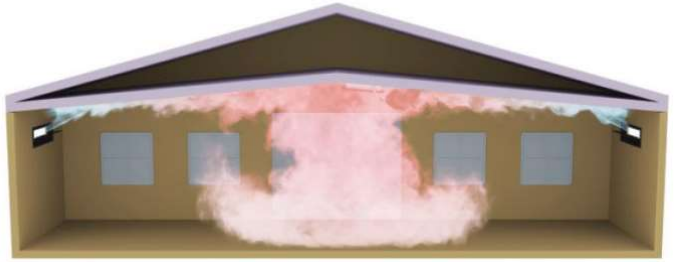
- Maintain as tight houses (cover full ventilation fans)
  - Eliminate uncontrolled inlets
- Make sure your lower staged fans are working correctly
- Run the correct number of fans for the way your minimum ventilation is designed
- When possible make sure your barns are set up that they can ramp up and down automatically
- Inlet air travels further when entrained along a surface
- Minimum ventilation inlets need to be opening properly to get the throw (amount of throw required is house/room design dependent)
  - **Buoyancy** of air changes



Not Good



Good



Inlet Air Velocity

- Good air mixing
- Tempering the air
- Even temperature

Summer Ventilation Basics

- Removing heat from the room
- Minimizing temperature rise in the room

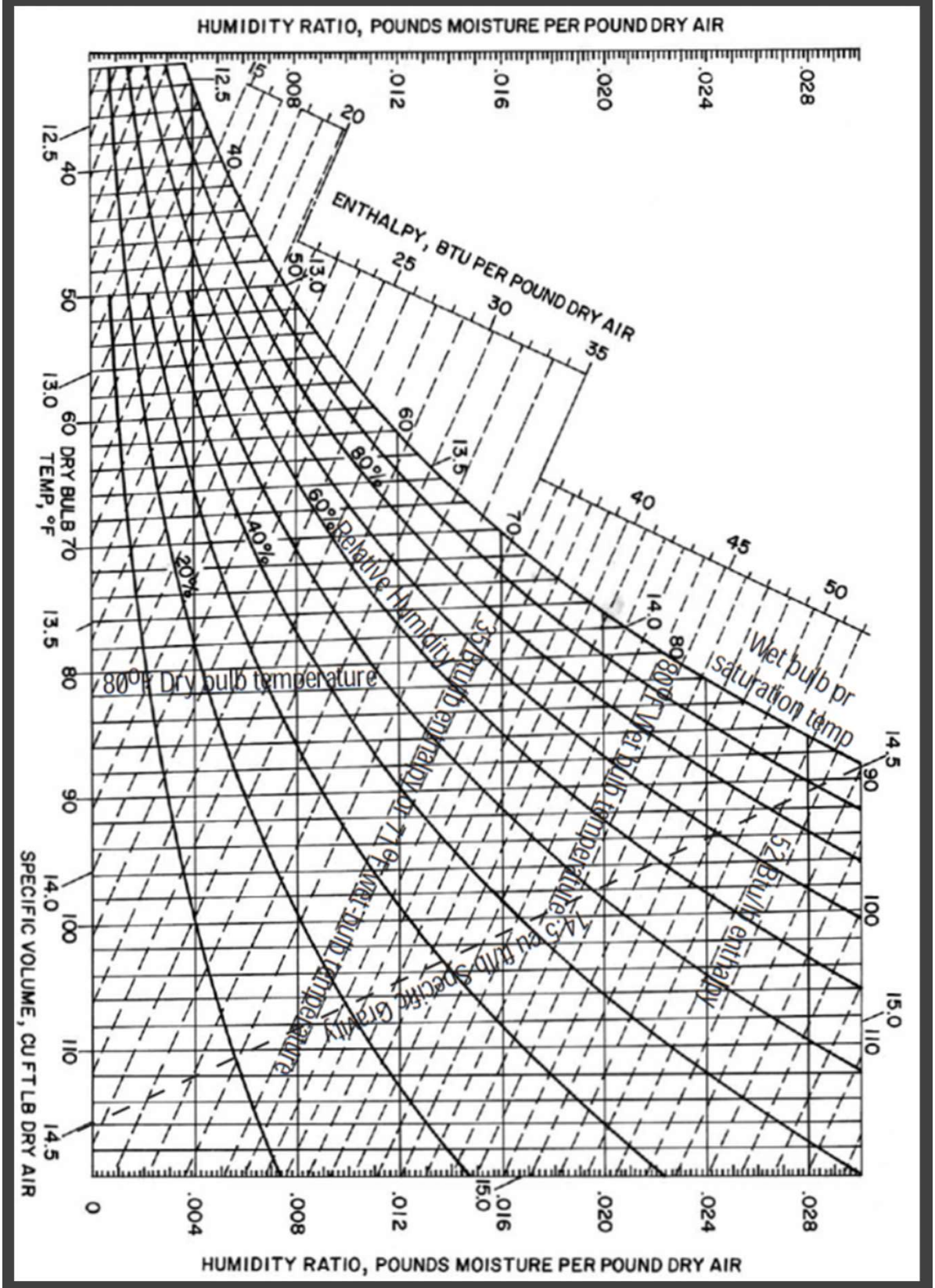
- Depending on barn design
  - Wind Chill
  - Evaporative Cooling

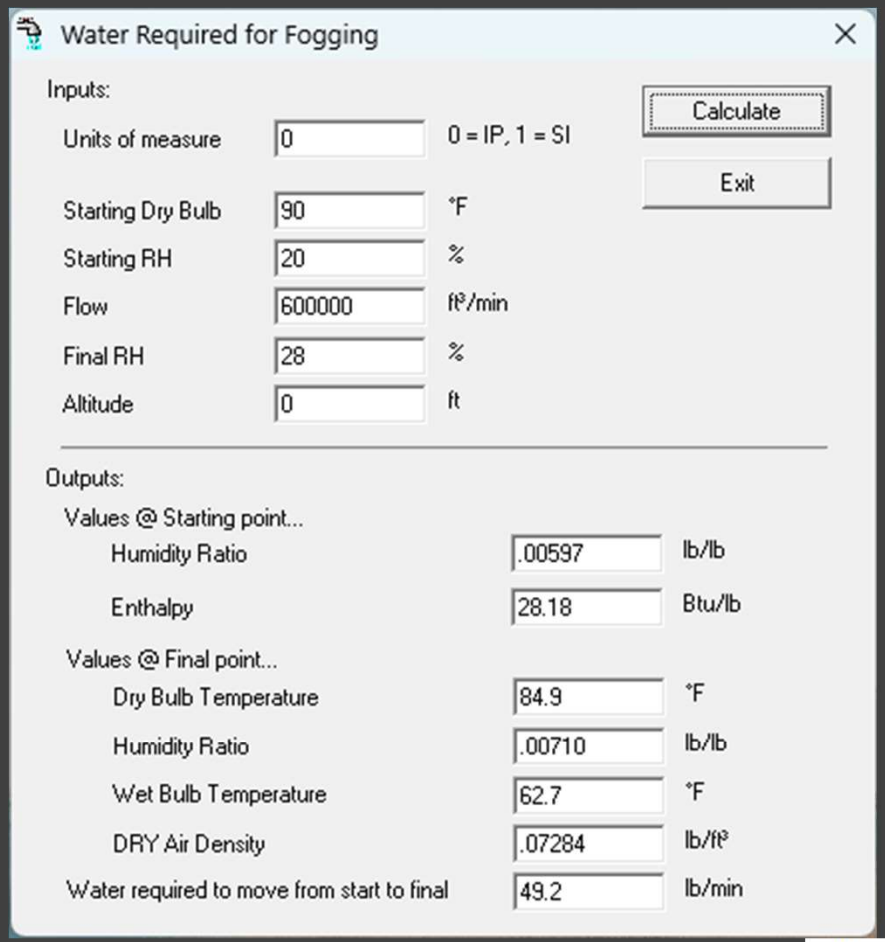
Summer Ventilation Basics

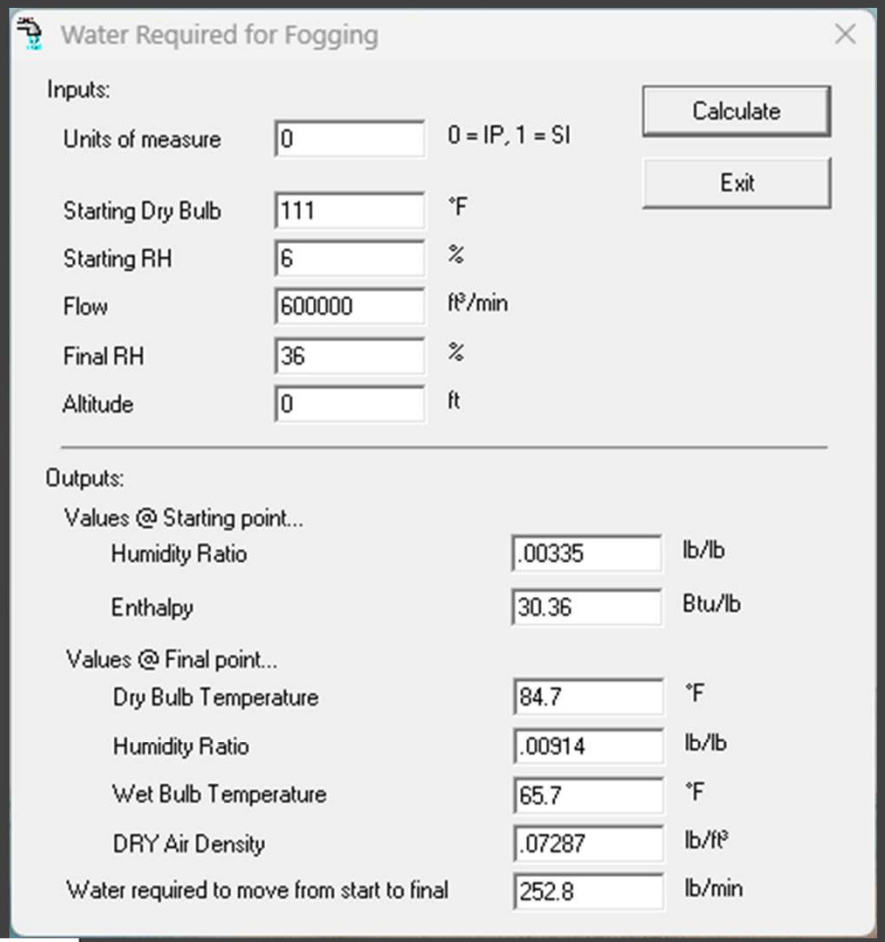
- Make sure all of your fans are operating properly; check belts/sheaves/motor/bearings based on fan manufactures maintenance schedule
- Verify actuators are working correctly
- Verify air is being directed where it should be for given barn design

- Air takes the path of least resistance, thus if the air movement isn't where the birds are benefiting from it or is less than it should be
  - May make sense to add resistance where you don't want the air movement to get it where you want it

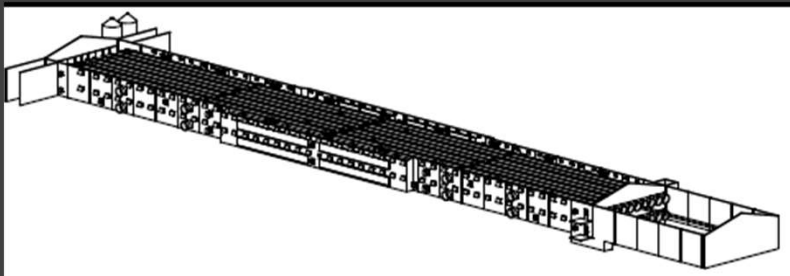
Psychrometric Chart



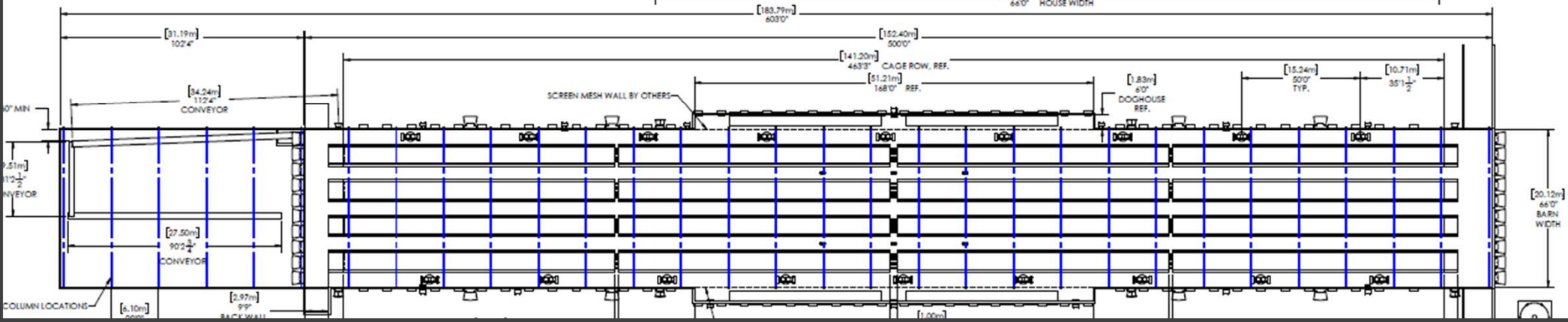


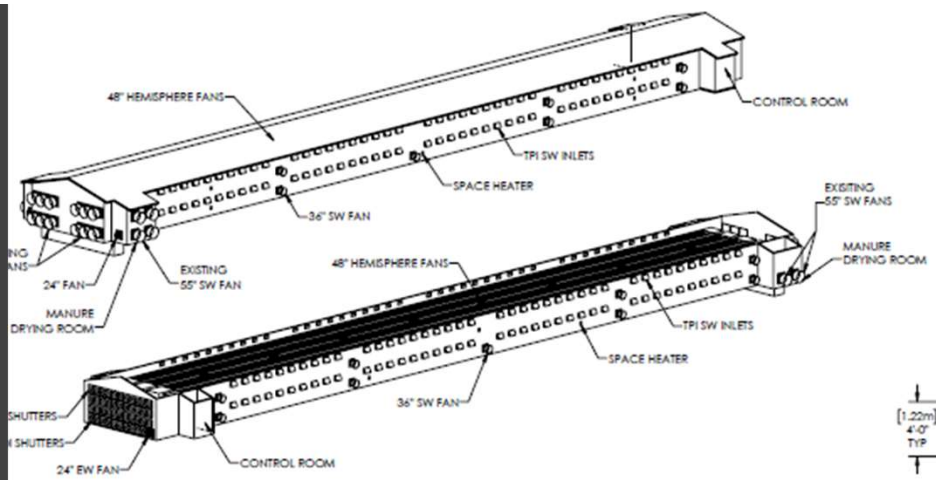


lbs of Water	Gallons of Water
49.2	5.906363
252.8	30.34814

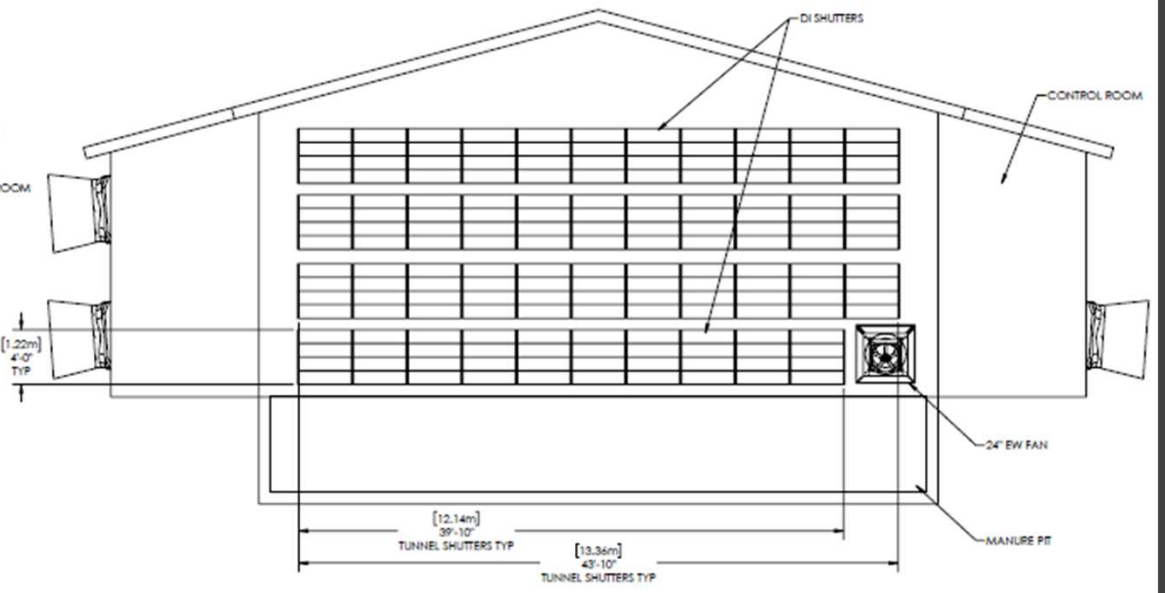


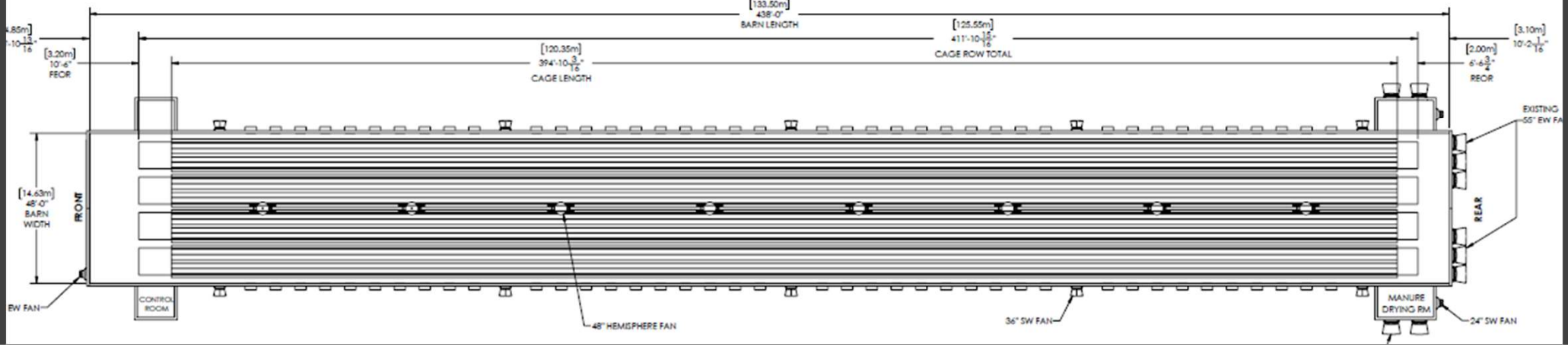
REV	ECO#	DESCRIPTION	DATE
A	-	INITIAL RELEASE	11/29/2023
B	-	ADDED ELECTRICAL ROOM/ LOAD-OUT DOOR, ADDED 4" SUPPORTS TO BUILDING (ADJUSTED VENTILATION EQUIPMENT TO SUIT)	1/22/2024
C	-	ADJUSTED PANEL REMOVED (1) FROM SIDEWALL AND MOVED TO BACK WALL	4/16/2024

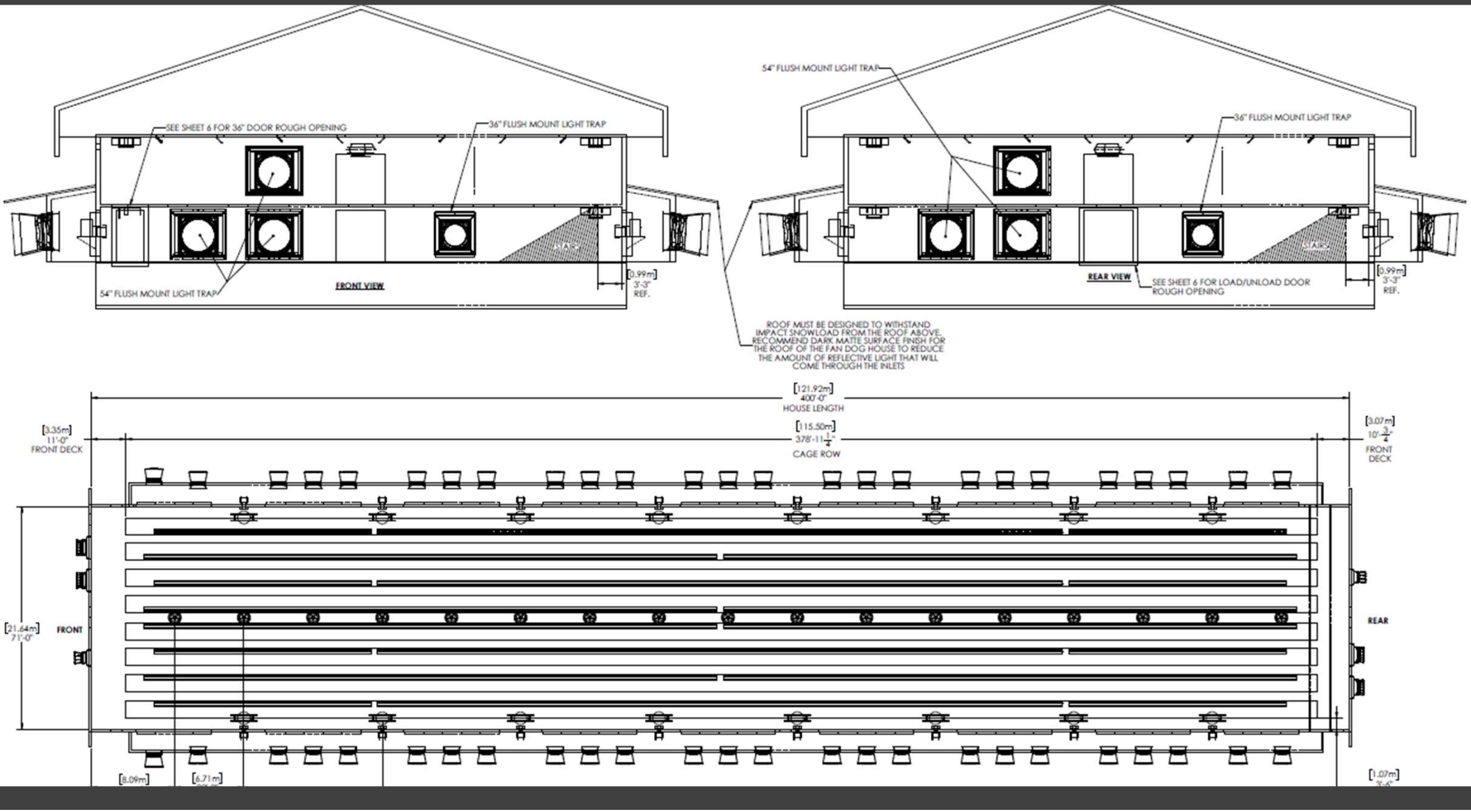


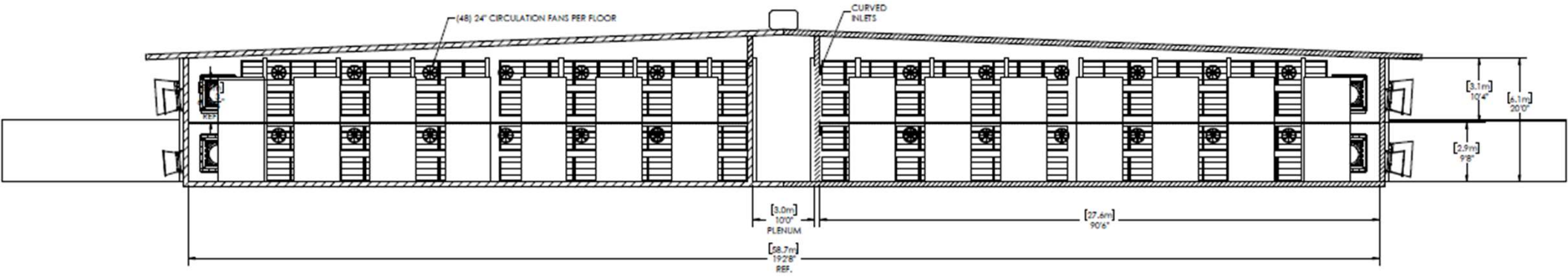

48" HEMISPHERE FANS
CONTROL ROOM
TPI SW INLETS
SPACE HEATER
36" SW FAN
24" FAN
EXISTING
55" SW FAN
MANURE
DRYING ROOM
48" HEMISPHERE FANS
EXISTING
55" SW FANS
MANURE
DRYING ROOM
TPI SW INLETS
SPACE HEATER
36" SW FAN
SHUTTERS
SHUTTERS
24" EW FAN
CONTROL ROOM

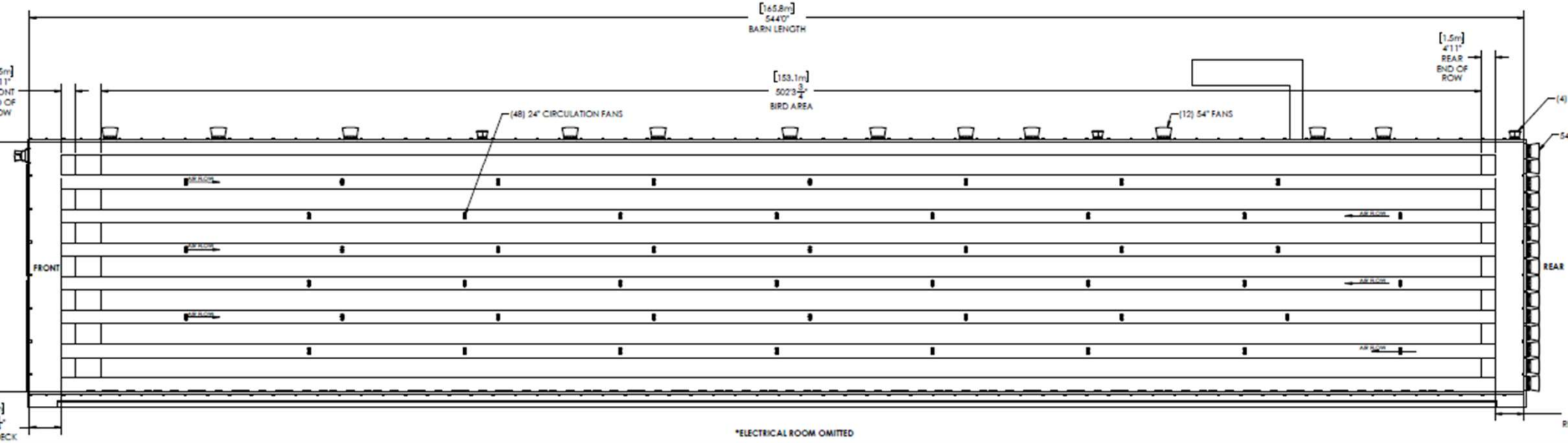

UPDATED FAN STAGING
RELOCATE CENTER SW FANS TO DOG HOUSE
RELOCATE FAN FROM DOG HOUSE
UPDATE MOTOR LIST QTY OF C.683


DI SHUTTERS
CONTROL ROOM
[1.22m]
4'-0"
TYP
24" EW FAN
[12.14m]
39'-10"
TUNNEL SHUTTERS TYP
[13.34m]
43'-10"
TUNNEL SHUTTERS TYP
MANURE PIT


[133.50m]
438'-0"
BARN LENGTH
[125.55m]
411'-10 5/16"
CAGE ROW TOTAL
[120.35m]
394'-10 3/16"
CAGE LENGTH
[3.20m]
10'-6"
FEOR
[2.00m]
6'-6 3/4"
REOR
[3.10m]
10'-2 1/16"
[14.63m]
48'-0"
BARN
WIDTH
FRONT
REAR
EXISTING
55" EW FA
EW FAN
CONTROL
ROOM
48" HEMISPHERE FAN
36" SW FAN
MANURE
DRYING RM
24" SW FAN


SEE SHEET 6 FOR 36" DOOR ROUGH OPENING
36" FLUSH MOUNT LIGHT TRAP
54" FLUSH MOUNT LIGHT TRAP
FRONT VIEW
[0.99m] 3'-3" REF.
54" FLUSH MOUNT LIGHT TRAP
36" FLUSH MOUNT LIGHT TRAP
REAR VIEW
SEE SHEET 6 FOR LOAD/UNLOAD DOOR ROUGH OPENING
[0.99m] 3'-3" REF.
ROOF MUST BE DESIGNED TO WITHSTAND IMPACT SNOWLOAD FROM THE ROOF ABOVE. RECOMMEND DARK MATTE SURFACE FINISH FOR THE ROOF OF THE FAN DOG HOUSE TO REDUCE THE AMOUNT OF REFLECTIVE LIGHT THAT WILL COME THROUGH THE INLETS
[121.92m] 400'-0" HOUSE LENGTH
[115.50m] 378'-11 1/2" CAGE ROW
[3.35m] 11'-0" FRONT DECK
[3.07m] 10'-3/4" FRONT DECK
[21.64m] 71'-0"
FRONT
REAR
[8.09m]
[6.71m]
[1.07m] 3'-6"





*ELECTRICAL ROOM OMITTED

Reference information including most of the pictures

- National Poultry Technology Center
  - https://ssl.acesag.auburn.edu/poultryventilation/NationalPoultryTechnologyCenter1.php
  - https://ssl.acesag.auburn.edu/poultryventilation/documents/Nwsltr-65SummertimeChecklists.pdf
  - https://ssl.acesag.auburn.edu/poultryventilation/documents/Nwsltr-41EvapCooling.pdf
  - https://ssl.acesag.auburn.edu/poultryventilation/documents/Nwsltr-71AvoidingElectricalCatastrophe.pdf
- https://extension.psu.edu/psychrometric-chart-use
- UGA poultry extension