



Quality heaters you can count on.

SENTINEL RADIANT TUBE HEATER

2005 DELMARVA GROW-OUT CONFERENCE
JOHN TOMLINSON
DIRECTOR OF ENGINEERING



- **SIMILAR TO A FORCED AIR BOX HEATER**
 - ◆ BURNER
 - ◆ IGNITION
 - ◆ GAS VALVE
 - ◆ FAN AND MOTOR
 - ◆ SAFETY CONTROL AND COMPONENTS

- **DIFFERENCE IS MEANS OF TRANSFERING HEAT**
 - ◆ HEATING THE AIR VS. HEATING THE TUBE



■ HEATS OBJECTS, NOT THE AIR

- ◆ ELECTROMAGNETIC WAVE ENERGY TRANSMISSION
 - ABSORPTION BY THE OBJECT CREATES THE 'HEAT'
- ◆ LIKE THE SUN
- ◆ IF YOU CAN SEE IT YOU CAN FEEL IT
- ◆ AMBIENT AIR IS HEATED BY ENERGY GIVEN OFF BY THE OBJECTS
 - AMBIENT AIR TEMPERATURE WILL BE LOWER THAN THE OBJECT TEMPERATURE

■ FOR POULTRY

- ◆ THE BIRD
- ◆ THE LITTER (GROUND)

■ COVERAGE IS KING

- ◆ MAXIMIZE HEAT AVAILABLE AT BIRD LEVEL
- ◆ HIGHEST EFFICIENCY IS LARGEST AREA TO HIGHEST TEMPERATURE FOR LEAST BTUH INPUT



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■ TO MAXIMIZE COVERAGE

- ◆ AT THE WIDEST POINT WHERE COVERAGE IS DESIRED, NEED TO BE ABLE TO SEE THE TUBE AT GROUND LEVEL
- ◆ MINIMIZE TEMPERATURE VARIATION OVER THE LENGTH OF THE TUBE
- ◆ MINIMIZE PEAK TEMPERATURE DIRECTLY UNDERNEATH THE TUBE



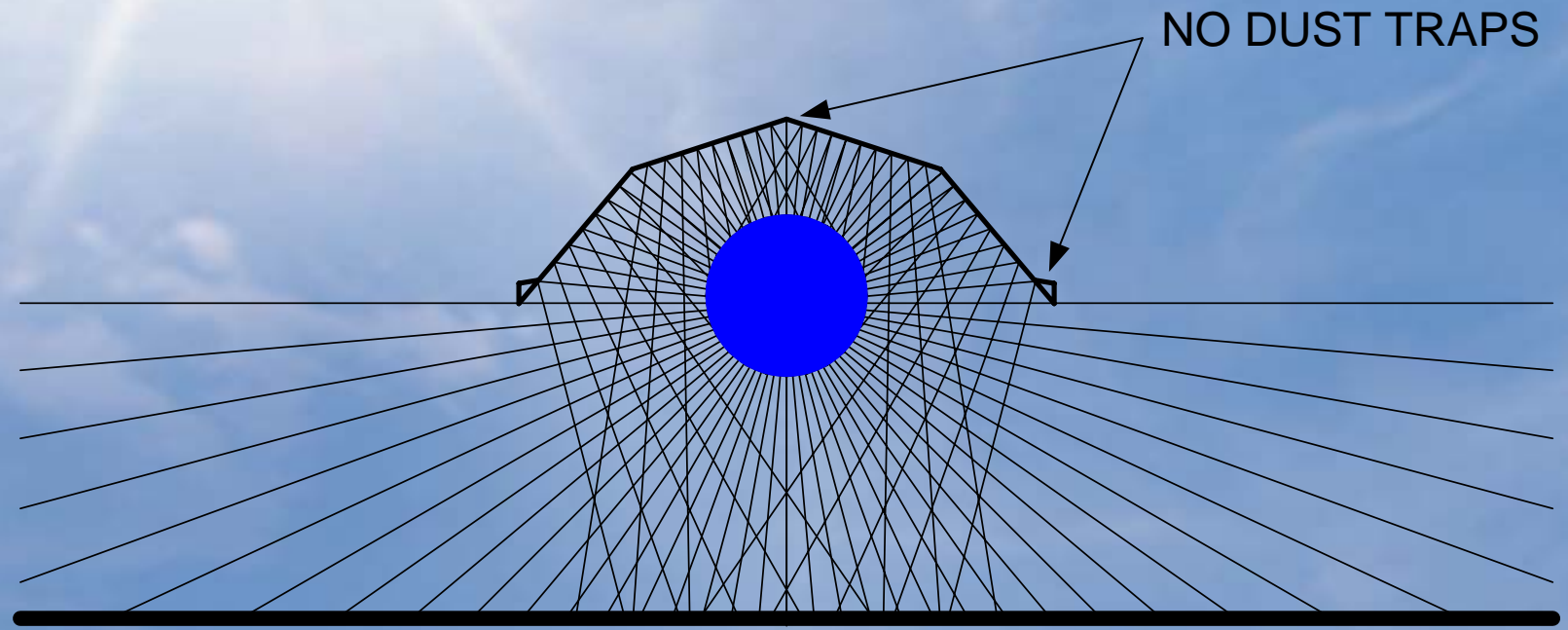
L.B. WHITE *RADIANT HEATING*

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■ Heat Pattern

- ◆ ACCOMPLISH WITH REFLECTOR DESIGN





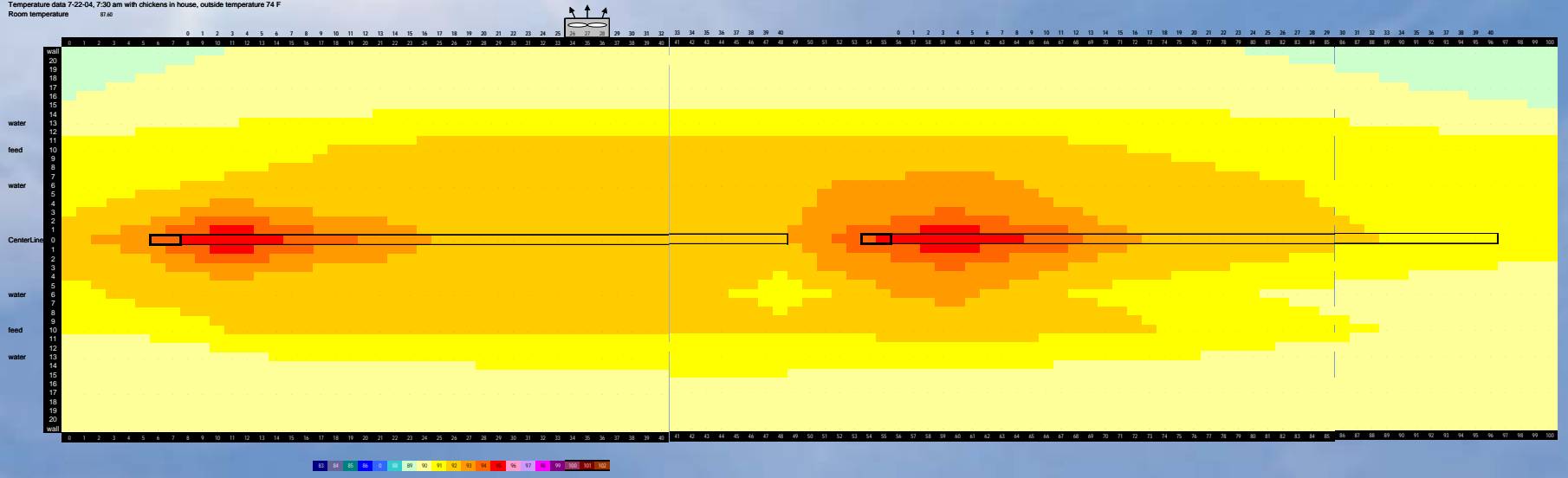
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■ WIDER REFLECTOR DESIGN - RESULTS

Temperature data 7-22-04, 7:30 am with chickens in house, outside temperature 74 F
Room temperature 87.68



NUMBER OF UNITS REQUIRED



■ DETERMINED BY

- ◆ TOTAL HEAT LOAD
- ◆ GROUND COVERAGE

■ TOTAL HEAT LOAD

- ◆ CONDUCTION LOSSES THROUGH THE HOUSE CONSTRUCTION
- ◆ VENTILATION AIR EXCHANGE

■ CONDUCTION LOSSES

- ◆ CAN UTILIZE A LOWER AMBIENT AIR TEMPERATURE IN RADIANT HEAT HOUSE
 - DAY 1 AT 83-85 Deg F. for radiant vs. 90-92 Deg F. for forced air
 - Utilize ASHRAE winter design temperature data
 - ◆ Eastern Shore is 5 Deg. F.

■ VENTILATION LOSSES

- ◆ WE ASSUME 0.2 CFM / BIRD AT DAY ONE AND 1 CFM / BIRD AT DAY 14



■ COVERAGE

- ◆ DETERMINED BY LENGTH AND WIDTH OF HEATED AREA AND TOTAL HEAT LOAD

- ◆ NEED QUANTITY OF UNITS WITH SUFFICIENT INPUT ENERGY TO MEET THE TOTAL HEAT LOAD REQUIREMENTS.

- ◆ BECOMES COMBINATION OF HEATER LENGTHS AND INPUT RATINGS TO COVER THE LENGTH OF THE HOUSE AS WELL AS THE WIDTH
 - MAXIMUM OF 20 FEET, LENGTHWISE, BETWEEN UNITS.
 - MOST PRODUCTS OFFERED WITH DIFFERENT LENGTHS FOR A GIVEN INPUT RATING
 - ◆ RECOMMEND LONGER THAN SHORTER LENGTH WHEN IT IS AN OPTION



- **AS A GENERAL RULE, LOCATED DOWN THE CENTER OF THE HOUSE**
 - ◆ AVOID BEING DIRECTLY OVER ANY FEED OR WATER LINES IF OFFSET FROM THE CENTER

- **AS A GENERAL RULE, WANT THE UNIT AS HIGH AS YOU CAN**
 - ◆ PROVIDES MAXIMUM WIDTH COVERAGE AND LOWEST TEMPERATURE DIRECTLY BELOW THE UNIT
 - ◆ CATCH MACHINE OR OTHER EQUIPMENT CLEARANCE
 - ◆ HAVE TO MAINTAIN COMBUSTIBLE CLEARANCES REQUIREMENT TO THE CEILING – 12 INCHES.

- **BURNER BOX END**
 - ◆ LOCATE TOWARDS THE HIGHEST LOSS AREAS
 - CURTAINS
 - DOORS
 - COOL CELLS / TUNNEL INLETS
 - ◆ 8-10 FEET FROM CURTAINS, DOORS

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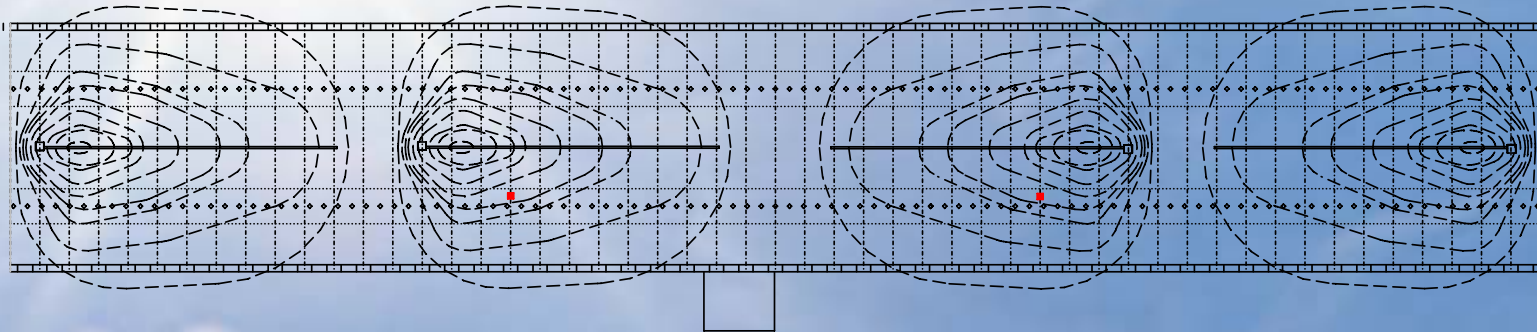
HEATER LOCATION and PLACEMENT

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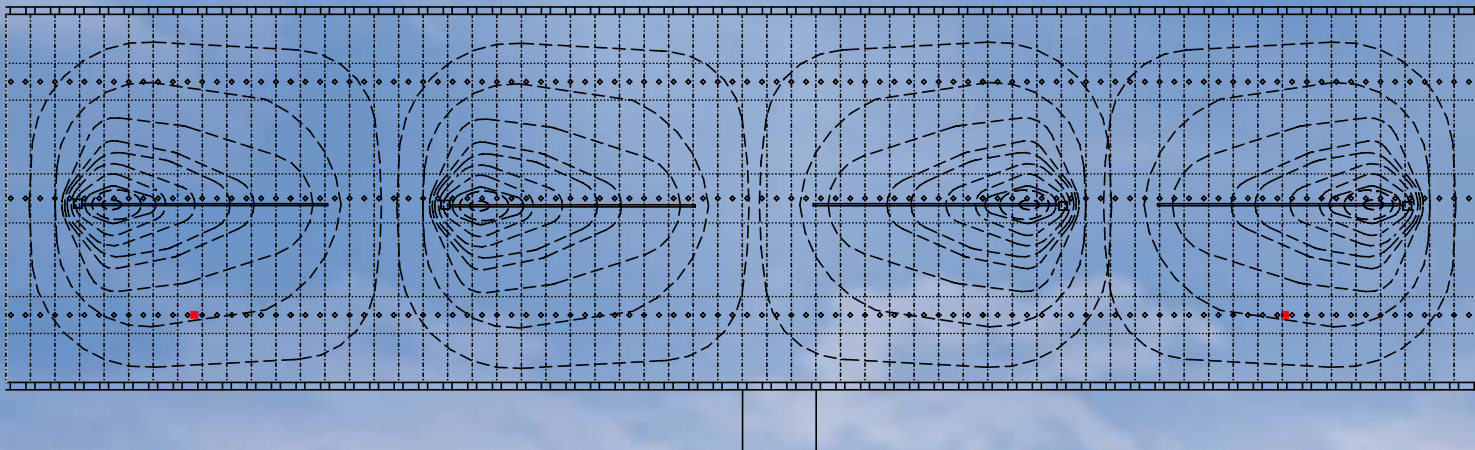
■ 40 – 43' WIDE HOUSES

◆ 40 X 520' CENTER BROOD



■ 60 - 66' WIDE HOUSES

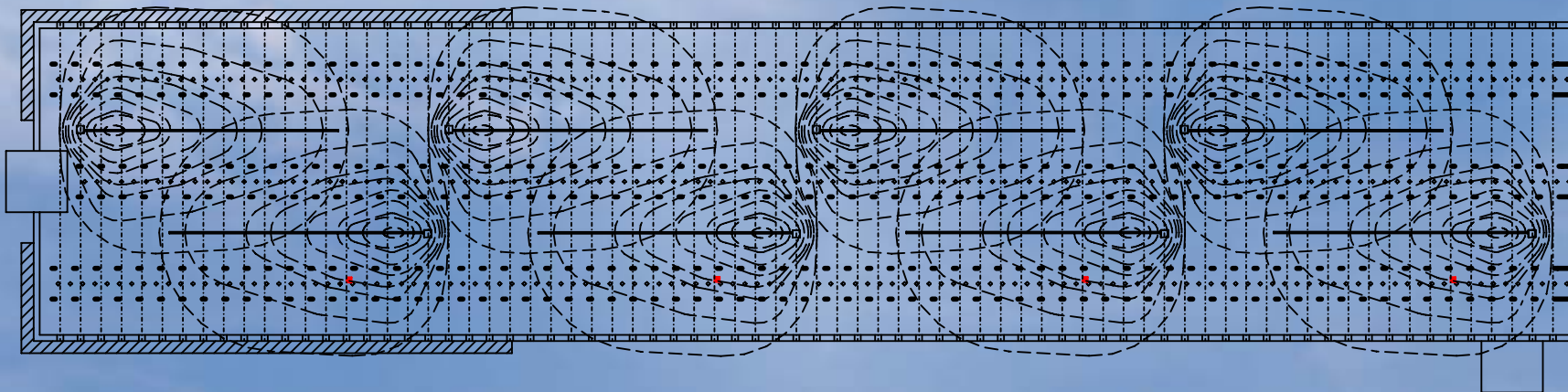
◆ 60 X 500' CENTER BROOD





■ 60 - 66' WIDE HOUSES

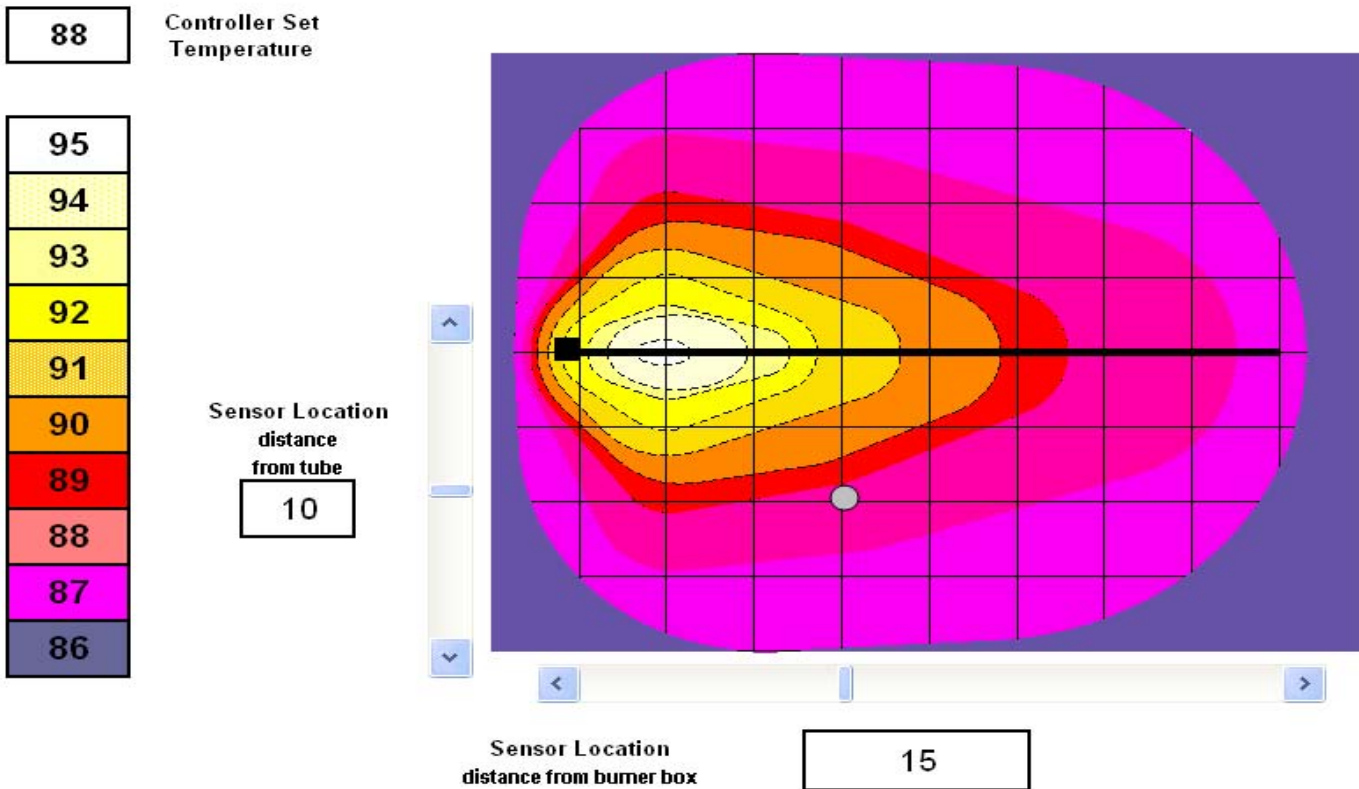
- ◆ 60 X 600' END BROOD
- ◆ HEATERS IN OPPOSITE DIRECTIONS
- ◆ HEATERS STAGGERED TO IMPROVE TEMPERATURE UNIFORMITY





Tube Heater Temperature Profile

With respect to sensor placement in radiant tube heater heat profile and sensor set point



- **SENSOR LOCATION 8 – 10” FROM GROUND**



■ CLEARANCES TO COMBUSTIBLE MATERIALS

- ◆ CEILINGS 12 INCHES
- ◆ SIDES 6 FEET
- ◆ BELOW 6 FEET

■ GAS PRESSURES AND PIPING TO UNITS

- ◆ TUBE HEATERS, AS WELL AS FORCED AIR BOXES, REQUIRE 11-13 INCHES WATER COLUMN GAS PRESSURE AT THE INLET TO OPERATE CORRECTLY
- ◆ GAS PIPING MUST BE SIZED TO PROVIDE SUFFICIENT CAPACITY AND PRESSURE FOR THE SYSTEM LOAD FROM THE REGULATOR THROUGHOUT THE REST OF THE SYSTEM.
- ◆ HEATER OUTPUT AND PERFORMANCE IS DIMINISHED UNLESS 11-13 INCHES WATER COLUMN LP (7-13 INCHES WATER COLUMN NG) GAS PRESSURE IS PRESENT AT EACH HEATER UNIT, WHETHER ONE UNIT IS RUNNING OR ALL UNITS ARE RUNNING.



GAS PRESSURES AND PIPING TO UNITS (cont.)

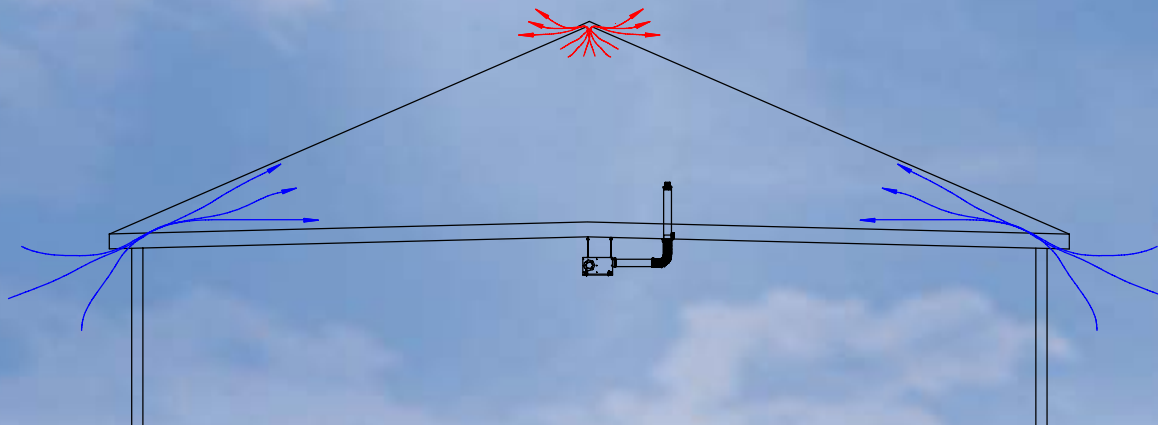


- SHORT $\frac{3}{4}$ " DIAMETER PIPE BETWEEN REGULATOR AND METER RESTRICTS THE CAPACITY OF THE SYSTEM
- GAS PRESSURES NEED TO BE CHECKED AT INSTALLATION AND AT PERIODIC INTERVALS TO ASSURE PRESSURES ARE CORRECT
- THESE ARE CONCERNS FOR ALL HEATERS, NOT JUST RADIANT TUBE HEATERS



■ ATTIC AIR SUPPLY

- ◆ TUBE HEATERS MUST NOT BE INSTALLED WHERE COMBUSTION AIR IS DRAWN FROM A NEGATIVE STATIC PRESSURE AREA.
- ◆ SOFFIT VENT AREA MUST EQUAL OR BE GREATER THAN RIDGE CAP VENT AREA. NEGATIVE ATTIC PRESSURE WILL OCCUR IF RIDGE CAP VENT AREA IS LARGER THAN SOFFIT VENT AREA.
- ◆ NEGATIVE STATIC PRESSURE IN THE ATTIC CAUSES
 - POOR COMBUSTION QUALITY AND LOWER EFFICIENCY
 - REDUCED TEMPERATURE UNIFORMITY ALONG TUBE LENGTH





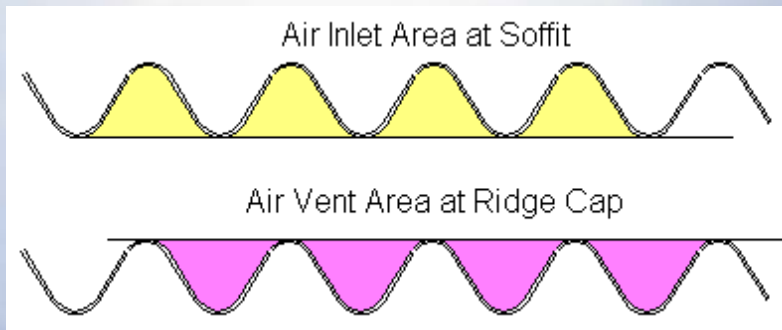
■ ATTIC AIR SUPPLY



THIS STYLE ROOF MATERIAL HAS SMALLER SOFFIT VENT AREA THAN ROOF CAP VENT AREA, CREATING A NEGATIVE PRESSURE IN ATTIC WHEN ATTIC AIR IS WARMER THAN OUTSIDE AIR



■ ATTIC AIR SUPPLY



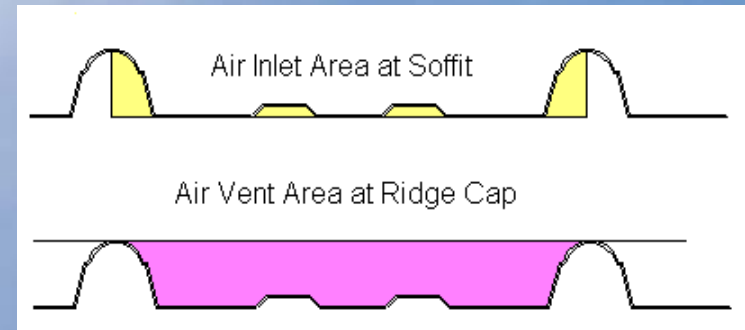
CORRUGATED ROOF MATERIAL

RIDGE CAP AREA 5.4 sq in

SOFFIT AREA 5.4 sq in

RIDGE CAP:SOFFIT AREA RATIO

1:1



PBR PANEL ROOF MATERIAL

RIDGE CAP AREA 9.0 sq in

SOFFIT AREA 1.8 sq in

RIDGE CAP:SOFFIT AREA RATIO

5:1

ROOF CAP AREA > SOFFIT AREA = NEGATIVE ATTIC PRESSURE



■ SINGLE STAGE (ON/OFF)

- ◆ STRAIGHT FORWARD WAY IS TO SWITCH THE MAIN POWER TO THE UNIT
 - NO EXTRA WIRING REQUIRED
- ◆ CAN RUN WIRES TO THE UNIT AND SWITCH THE 24 VAC IN THE UNIT
 - NON-POWERED CONTACTS AT THE CONTROLLER

■ TWO-STAGE (OFF – MEDIUM – HIGH)

- ◆ SWITCH THE 24VAC
 - SUPPLIED IN THE UNIT, NO EXTRA TRANSFORMER REQUIRED
- ◆ TWO NON-POWERED RELAY CONTACTS REQUIRED PER HEATER OR ZONE
 - CONTROL WIRES RUN TO UNIT

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SENTINEL LENGTHS AND RATINGS

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Single Stage	High Rate		30 foot	40 foot	50 foot
	80 K Btu-hr		X		
	100 K Btu-hr		X	X	
	125 K Btu-hr			X	X
	150 K Btu-hr				X

Two Stage	High Rate	Medium Rate	30 foot	40 foot	50 foot
	80 K Btu-hr	48 K Btu-hr	X		
	100 K Btu-hr	60 K Btu-hr	X	X	
	125 K Btu-hr	75 K Btu-hr		X	X
	150 K Btu-hr	90 K Btu-hr			X

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OTHER INSTALLATION ASPECTS

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■ L. B. White Sentinel Radiant Tube Heater

