TUBE HEATER BASICS

- **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
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
Heat Pattern

- ACCOMPLISH WITH REFLECTOR DESIGN

NO DUST TRAPS
WIDER REFLECTOR DESIGN - RESULTS
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
NUMBER OF UNITS REQUIRED

- 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
HEATER LOCATION and PLACEMENT

- **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
**HEATER LOCATION and PLACEMENT**

- **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
SENSOR LOCATION 8 – 10” FROM GROUND
OTHER INSTALLATION ASPECTS

- 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 ¾” 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

PBR PANEL ROOF MATERIAL
RIDGE CAP AREA  9.0 sq in
SOFFIT AREA  1.8 sq in

RIDGECAP:SOFFIT AREA RATIO
1:1

ROOF CAP AREA > SOFFIT AREA = NEGATIVE ATTIC PRESSURE
CONTROLS INTEGRATION

- **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
## Sentinel Lengths and Ratings

### Single Stage

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<tr>
<th>Length (K Btu/hr)</th>
<th>High Rate</th>
<th>30 foot</th>
<th>40 foot</th>
<th>50 foot</th>
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OTHER INSTALLATION ASPECTS

- L. B. White Sentinel Radiant Tube Heater