

# **SSR Cooling System Briefing**

by

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# Cooling System Components

- **Main Cooling Fan**
  - Provides airflow across the radiator and the A/C condenser
  - “Turn-on” logic is controlled by the computer
    - Main fan to low at 226F (rising) and off at 219F (falling)
    - Main fan to high at 235F (rising) and to low at 226F (falling)
    - Main Fan off at speeds above 35mph
    - Main fan to low when A/C reaches 200psi (rising) and off at 150psi (falling)
    - Main fan to high when A/C reaches 230psi (rising) and to low at 215psi (falling)
- **Thermostat**
  - Will not allow any coolant to the radiator until the water pump inlet temperature reaches 187F
  - Modulates radiator (cool) and the engine return (hot) flow to maintain water pump inlet at 187F
- **Pressure Cap**
  - Maintains 15psi pressure on an operating engine
  - Provides escape route for excess coolant
  - Provides air inlet route for maintaining system volume when cooling

# Cooling System Components cont'd.

- **Surge Tank**
  - Acts as an accumulator in the cooling system to allow for coolant expansion when hot
  - Provides air bubble removal central point in system
  - Provides buffering of surges in cooling system volume that come with engine rpm changes
- **Radiator**
  - Exchanges heat from the cooling system into the air
  - Has 30 – 40 degree F drop across the radiator for supplying “cool” coolant to the engine
  - Bleed line removes air bubbles that accumulate in the upper tank of the radiator and sends them to the surge tank
- **Water Pump**
  - Pulls coolant through the thermostat housing and provides it throughout the engine for cooling
- **Steam Vent Line**
  - Bleed line that removes air bubbles from the cylinder heads and sends them to the surge tank

# Know your cooling system regulation point

- Highway cruise speed will yield “nominal” point for reference on the temp gauge
  - Low speed issues typically indicate an airflow problem
  - High speed issues typically indicate all except an airflow problem
- Symptoms related to parts:
  - Main Cooling Fan
    - Causes overheating at speeds below 35 mph.
    - Most evident in “stop-and-go” traffic
  - Thermostat
    - Causes shift from “nominal” reference point
    - Can show up at various conditions, depending on the type of malfunction
  - Pressure Cap
    - Causes shift from “nominal” reference point
    - Can show up at various conditions, depending on the type of malfunction
    - Collapsing upper hose is a dead give-away
  - Pressure Tank
    - Causes shift from “nominal” reference point
  - Radiator
    - Causes shift from “nominal” reference point when taxed
    - Noticeable inability to recover from short term heat load
  - Water Pump
    - Causes shift from “nominal” reference point at low speeds

# Things to know

- Properly pressurizing system will run at 15psi
- 3 degrees F for every PSI of pressure (15psi = 45F)
- Altitude affects boiling point of cooling system
  - 5,000 feet lowers boiling point about 9 degrees
- Air in coolant increases coolant temperature in cylinder heads
- Air in coolant decreases radiator efficiency
- High rpm engine operation tends to cavitate water pump (creating more air bubbles)
- Water pump cavitation is suppressed with increased pressure (like 15psi)
- Air Dam reduces re-ingestion of hot air at low speeds
- Foam air blocking pads are critical to forcing air through the radiator
- Overheating at high speed is a system problem
- Overheating at low speed is an airflow problem

# Radiator Efficiency

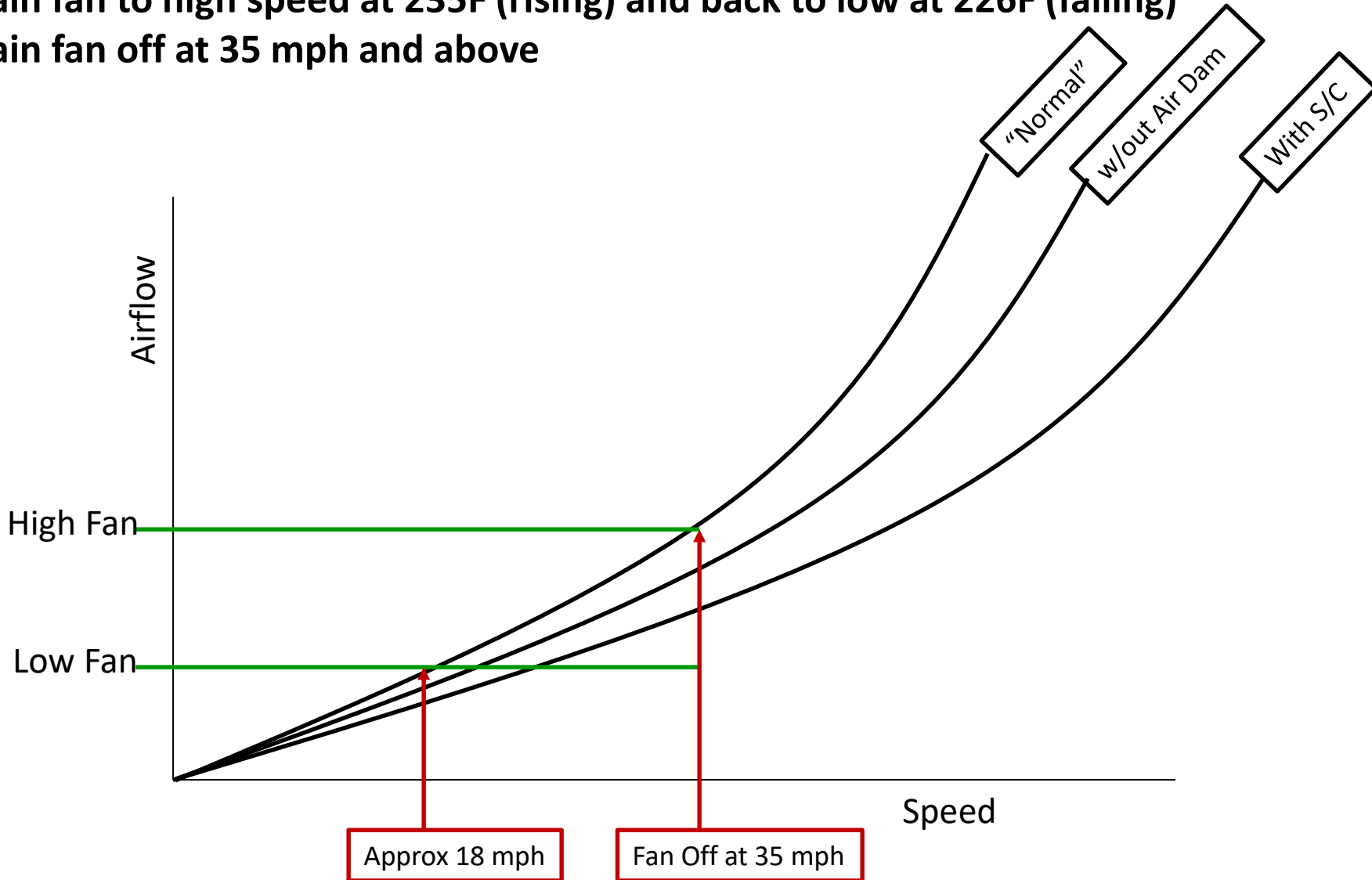
$$\text{BTU Extraction} = (\text{Surface Area}) \times (\text{Delta T}) \times (\text{Airflow})$$

This is a primary system capacity consideration

- **Surface Area = Cooling tube surface area + Fin surface area**
  - More surface area means more heat can be transferred
- **Delta T = Difference between coolant and air temperatures**
  - Higher Delta T means more heat can be transferred
- **Airflow = Mass flow across the radiator**
  - Higher flow across radiator means more heat can be transferred
  - Mass flow is used, because it takes air density into consideration
  - Denser air means more heat can be transferred

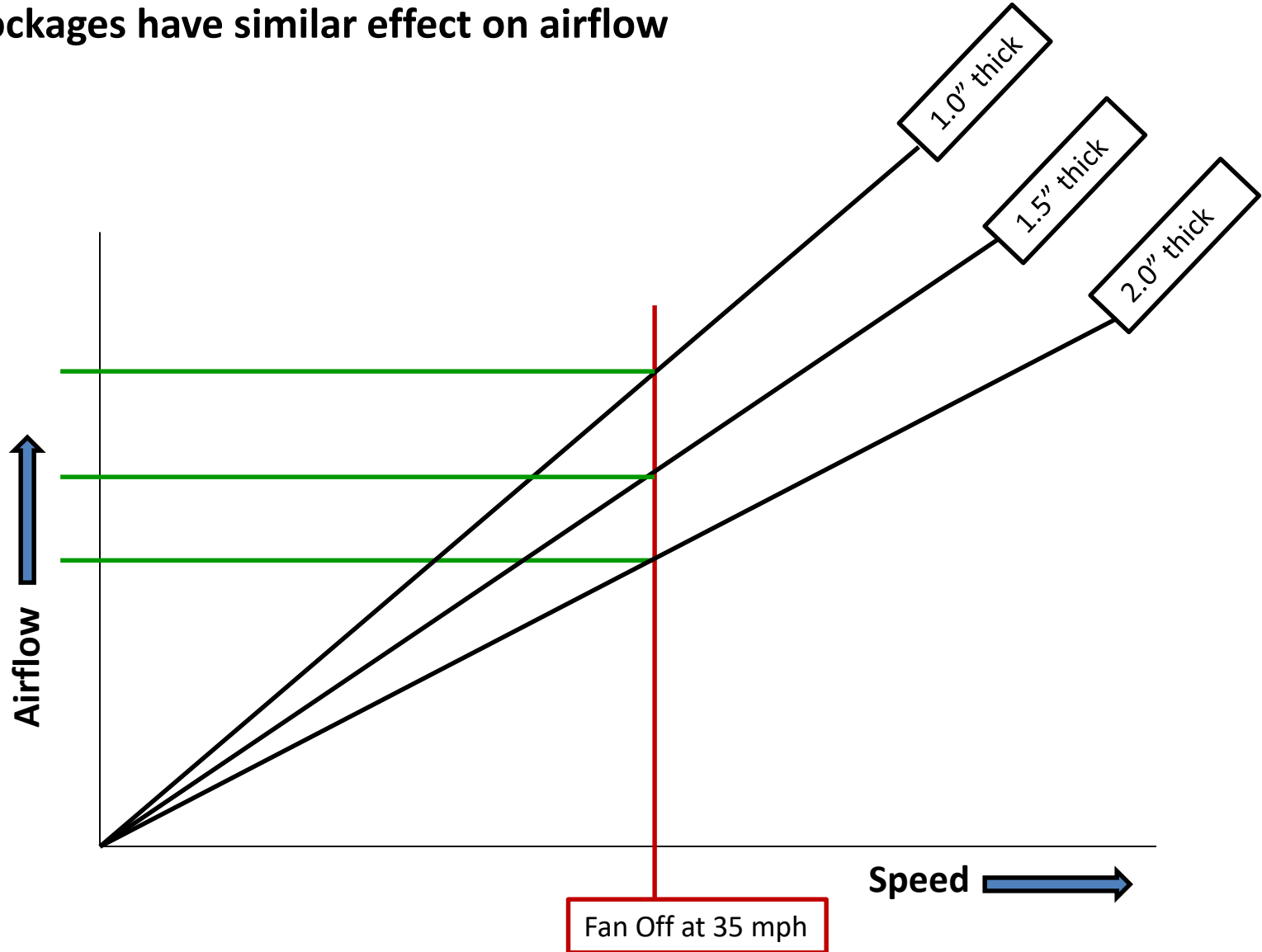
# Airflow

- Main fan to low speed at 226F (rising) and back off at 219F (falling)
- Main fan to high speed at 235F (rising) and back to low at 226F (falling)
- Main fan off at 35 mph and above



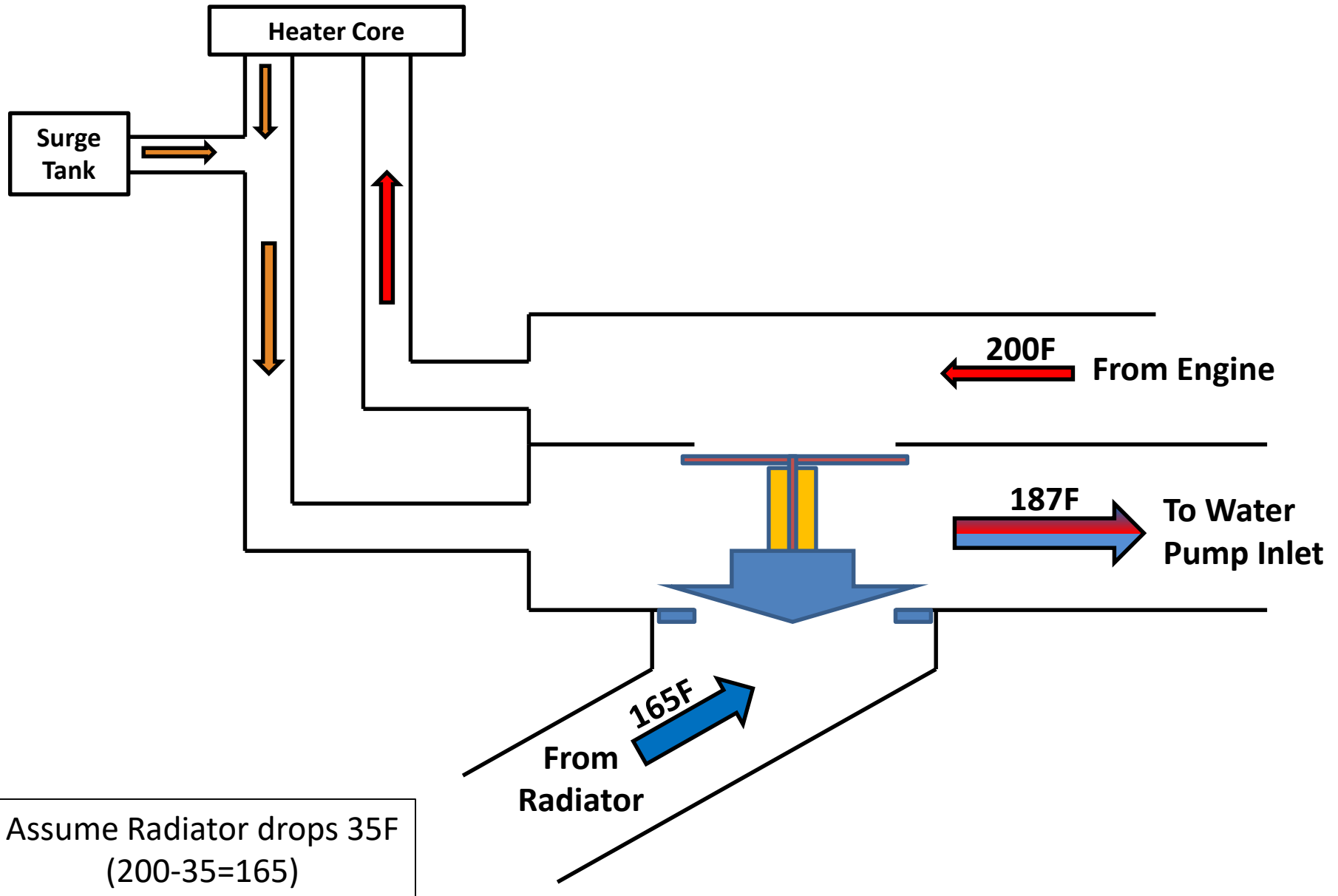
# Airflow Restrictions

- Installing a thicker radiator does not necessarily improve cooling
- Any blockages have similar effect on airflow





# Thermostat & Housing



# Thermostat Operation

