
# $SO_3$ Injector Fouling Causes and Solutions

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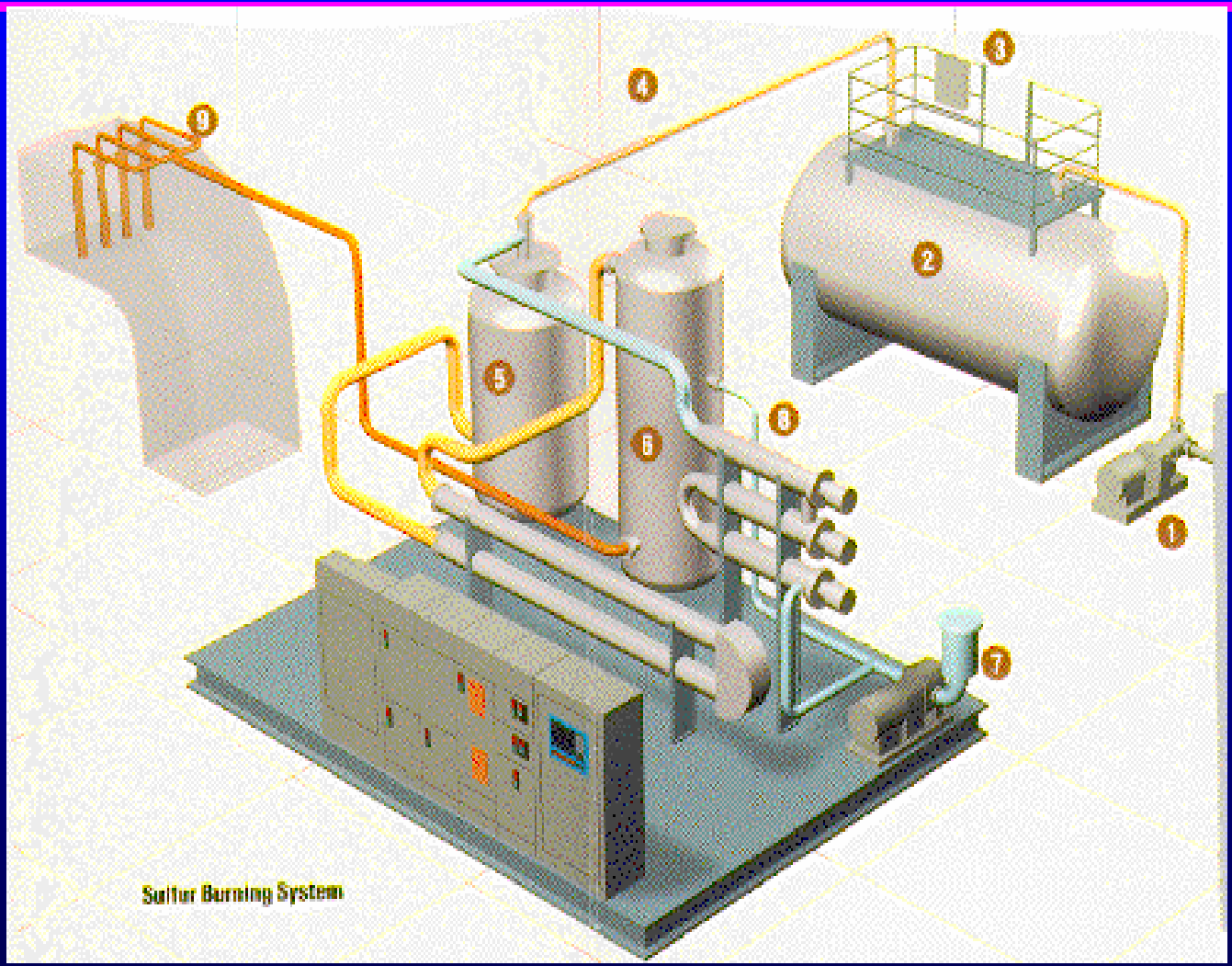
# Presentation Topics

- $SO_3$ overview
- Typical $SO_3$ system
- Preventing $SO_3$ injector fouling

# $SO_3$ Conditioning Overview

- Sulfur is burned to form $SO_2$ which is then converted to $SO_3$ and injected into the flue gas stream
- $H_2O$ in flue gas stream combines with $SO_3$ to form $H_2SO_4$ (sulfuric acid) mist in flue gas
- Sulfuric acid condenses on fly ash reducing resistivity
- Increasing collection efficiency of the ESP

# Typical $SO_3$ System




1 Unloading Pump
2 Storage Tank
3 Metering Pump
4 Liquid Sulfur at 135°C
5 Sulfur Burner
6 Multi-Stage Converter
7 Air Blower
8 Air Heater
9 $SO_3$/Air at 475°C

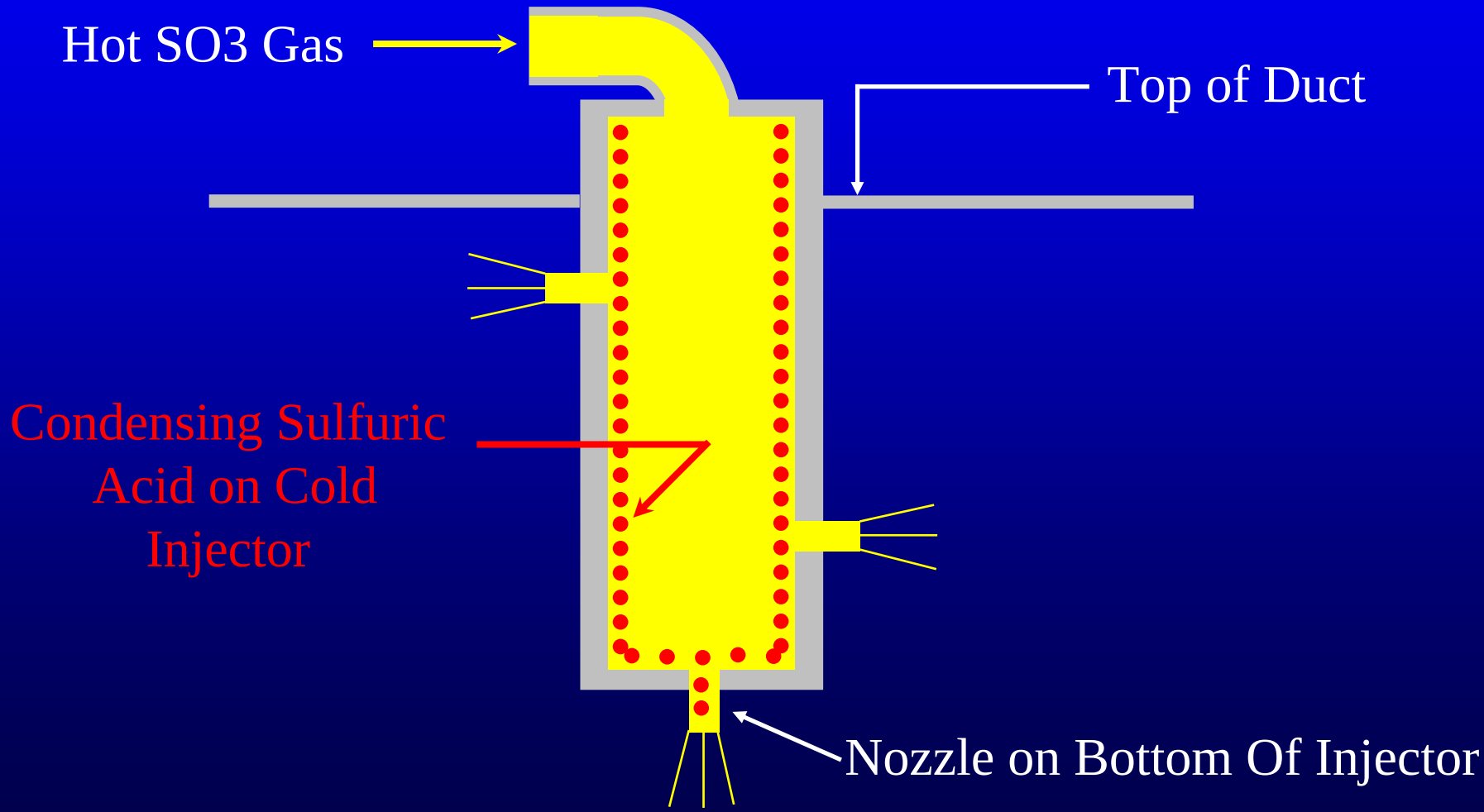
# Prevention of Fouling

- Orientation of probes in duct work
- Operational methods
- Equipment tuning
- Maintenance

# Injector Installations

- Vertical from top of duct
- Horizontal from sides of duct
- Vertical from bottom of duct

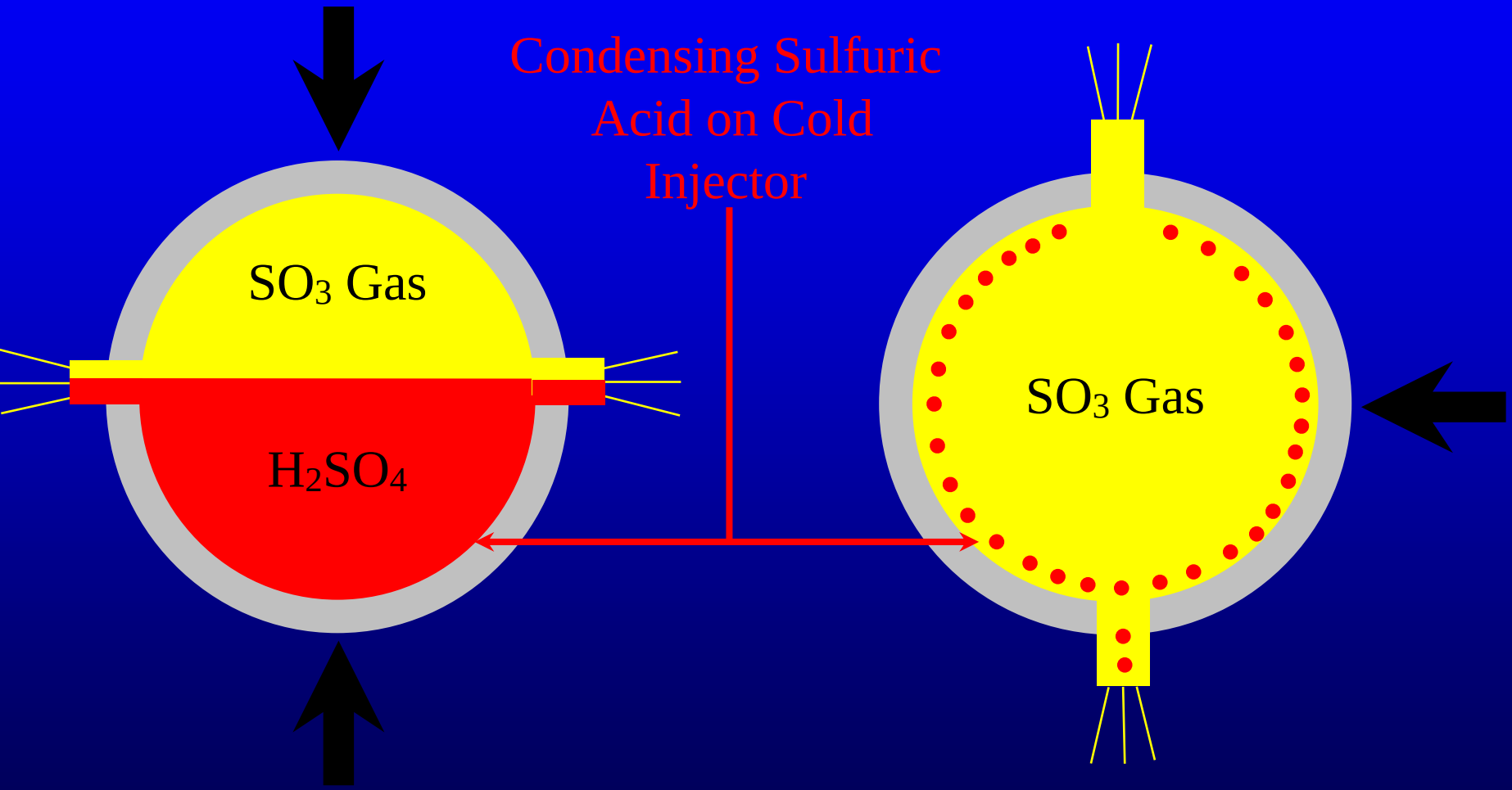
# Vertical From Top



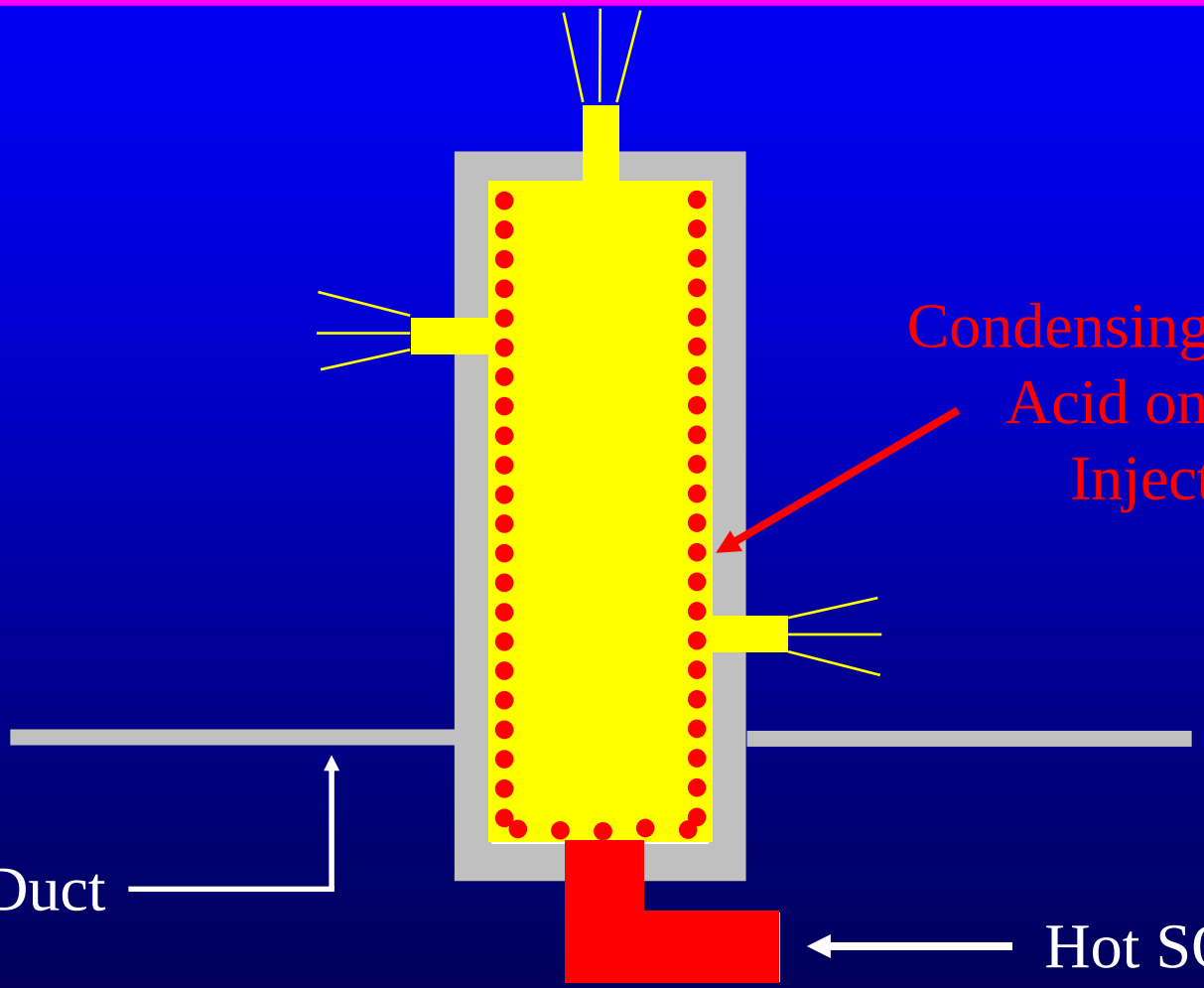
# Vertical From Top

- Clean and well drained

# Horizontal Injectors



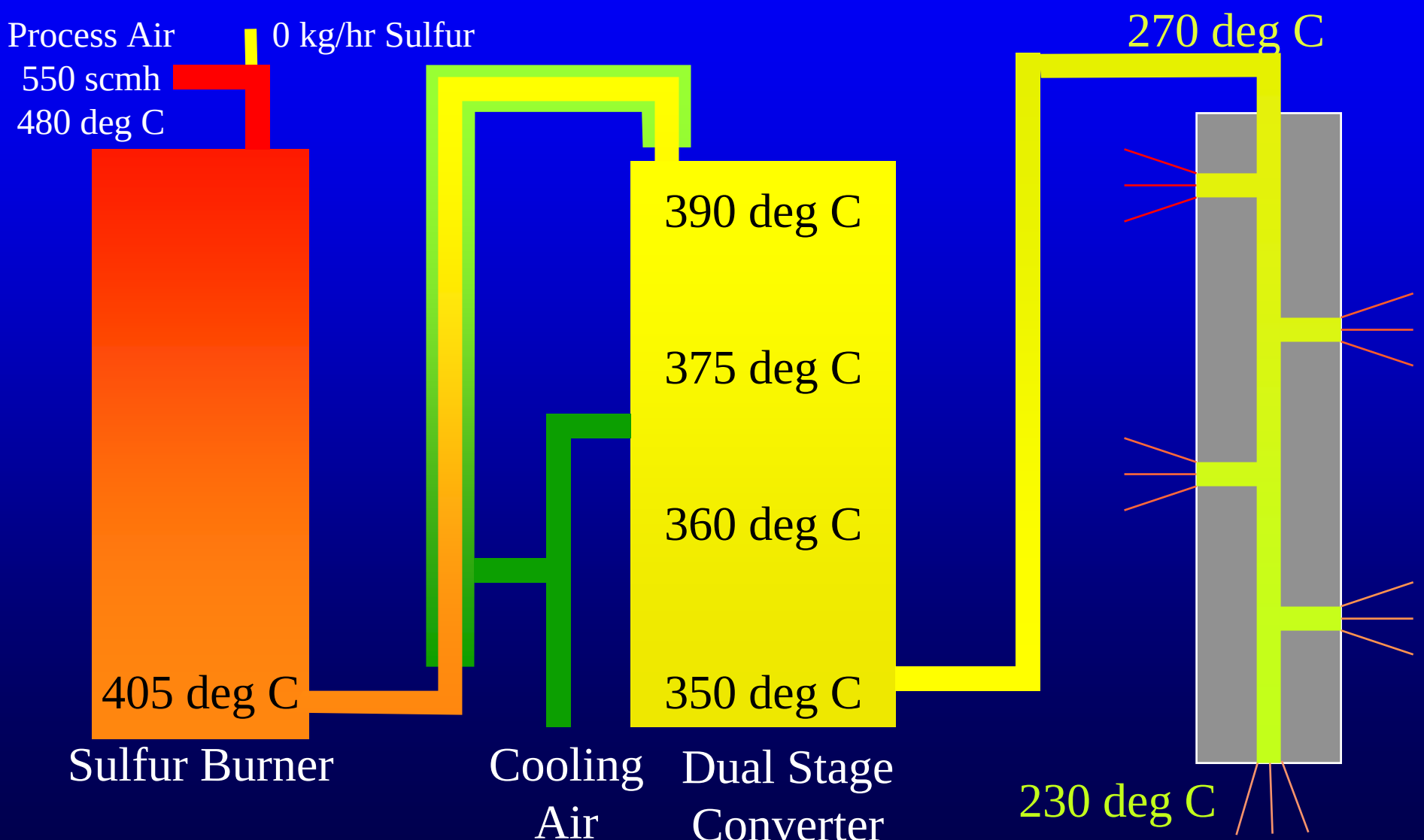
# Bottom Injectors



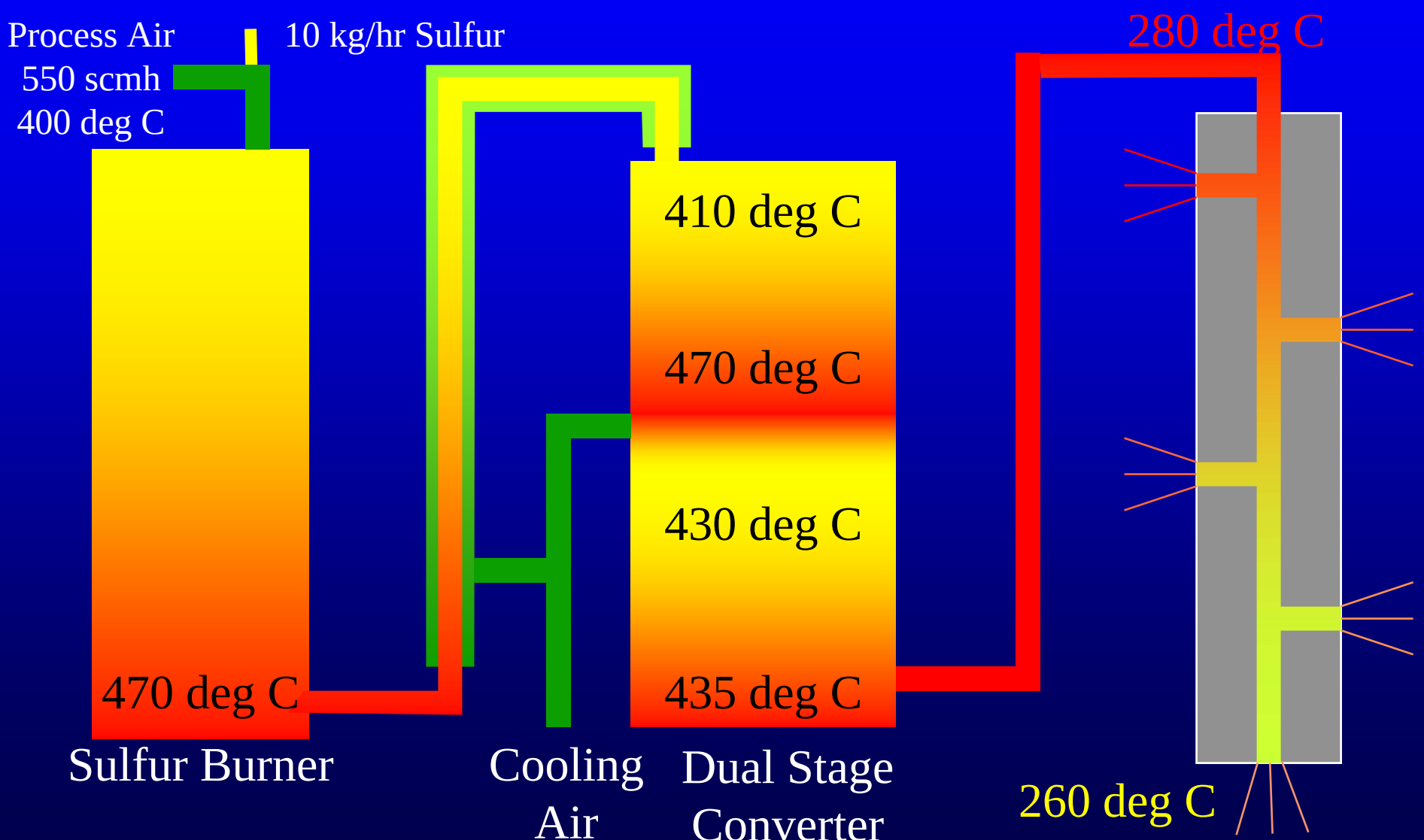
# Bottom Injector Installation Piping

# Bottom Injector Installation in Duct

# Start-up Temperature Profile



# Low Treat Rate Temperature Profile



# Low Temperature Problems

- A sulfur burn rate of 40 kg/hr together with the moisture in atmospheric air has the capacity to form 82 kg/hr of sulfuric acid at injectors if dew point is reached

# Low Temperature Operation

- Sulfuric acid formation on injector

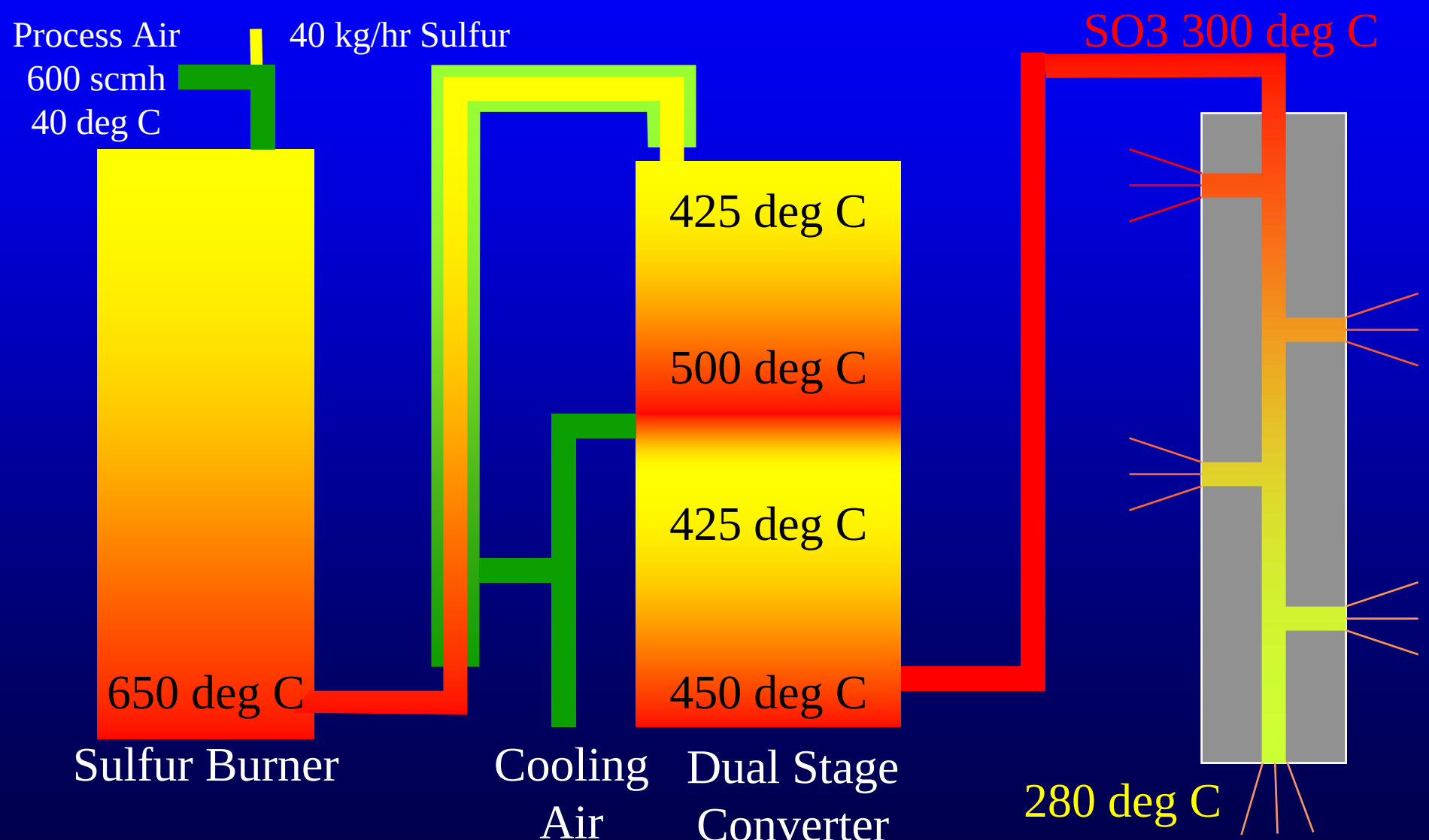
# Low Temperature Operation

- Destruction of nozzle

# Low Temperature Operation

- Plugging of nozzle

# Ideal Temperature Profile



# Ideal Temperature

- Clean open nozzles

# Power Plant Operation

- Start $SO_3$ system as soon as FD or ID fans are put in operation
  - Prevents dust from entering injector
  - Allows $SO_3$ system time to reach operating temperature prior to ESP requiring $SO_3$ treatment to reduce opacity
- If two shifting leave SO3 system in hold at 480 deg C to keep injectors hot

# Shutting Down System

- Stop burning sulfur and allow ample time to purge gases from system
  - Most systems have purge mode
    - » Keeps system hot to prevent formation of acid
    - » Keeps air flowing to purge residual $SO_3$ from system
- Keep system in standby mode if ID or FD fans are operational
  - Prevents dust from entering injectors

# Maintenance

- $SO_3$ gas generating skid
  - Heater operation
  - Insulation of converter vessel
- Sulfur storage and piping
  - Steam leaks into sulfur
    - » Sulfur Tank
    - » Sulfur Piping

# Maintenance

- $SO_3$ gas piping insulation

# Conclusions

- Fouling of injectors can be minimized or prevented by
  - Proper installation of system
  - Operation guidelines
  - System tuning
  - Maintenance