Energy & Store Development Conference

E+SD 2016

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THE VOICE OF FOOD RETAIL

Energy & Store
Development Conference
E+SD 2016

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Why Is Humidity Control Important?

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PRODUCT DISPLAY

Why Is Humidity Control Important?

SAFETY / HEALTH

- Water on floor – Slip Hazard
- High Humidity – Fungus/Mold
- High Humidity – Dust Mites

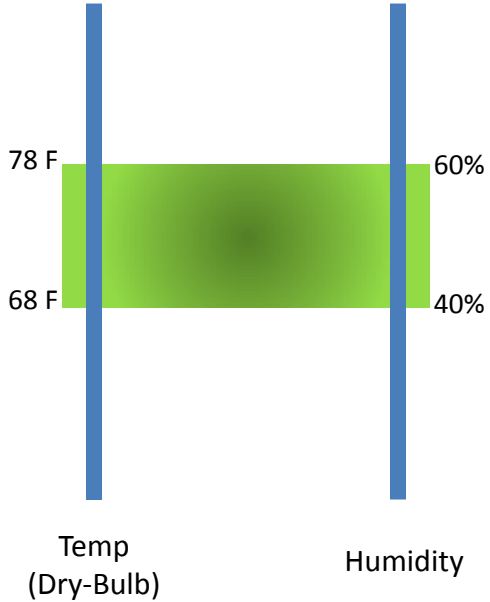
Why Is Humidity Control Important?

INCREASED MAINTENANCE

- Iced up Coils
- Floor Cleanups

Why Is Humidity Control Important?

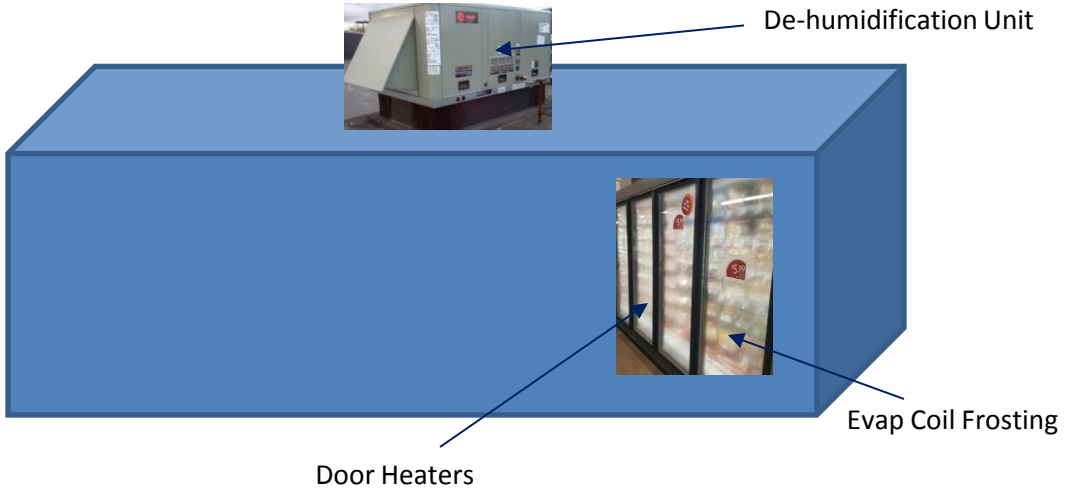
Comfort



Why Is Humidity Control Important?

ENERGY

- Higher Refrigeration Energy (Frosting/Defrosting)
- High Door Heater Run-rate (if using ACHC)
- High HVAC Energy for De-humidification



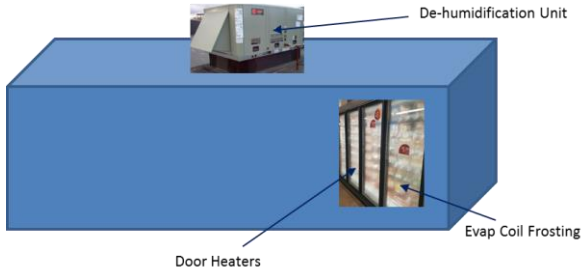
Why Is Humidity Control Important?

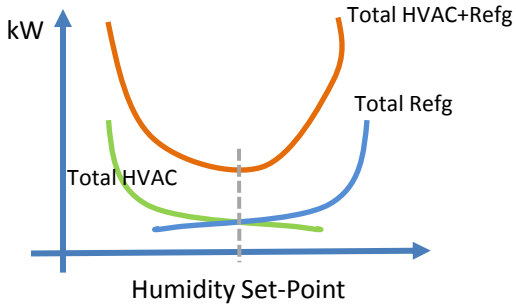
DECREASED ASSET LIFE

- Corrosion / Rust

Energy & Humidity

- If you keep your store de-humidification set-point high, it increases energy consumption in door heaters and refrigeration system but reduces energy in DHU.
- But if you lower store de-humidification set-point, it will help refrigeration system but will require DHU to run harder.
- It is always better to remove moisture using DHU rather than at refrigerated coils (EER of DHU are typically 10, but refrigeration equipment is typically 3-5).





What is the right De-humidification settings?

Definitions

DRY-BULB TEMPERATURE. Temperature of air without moisture and radiation effects.

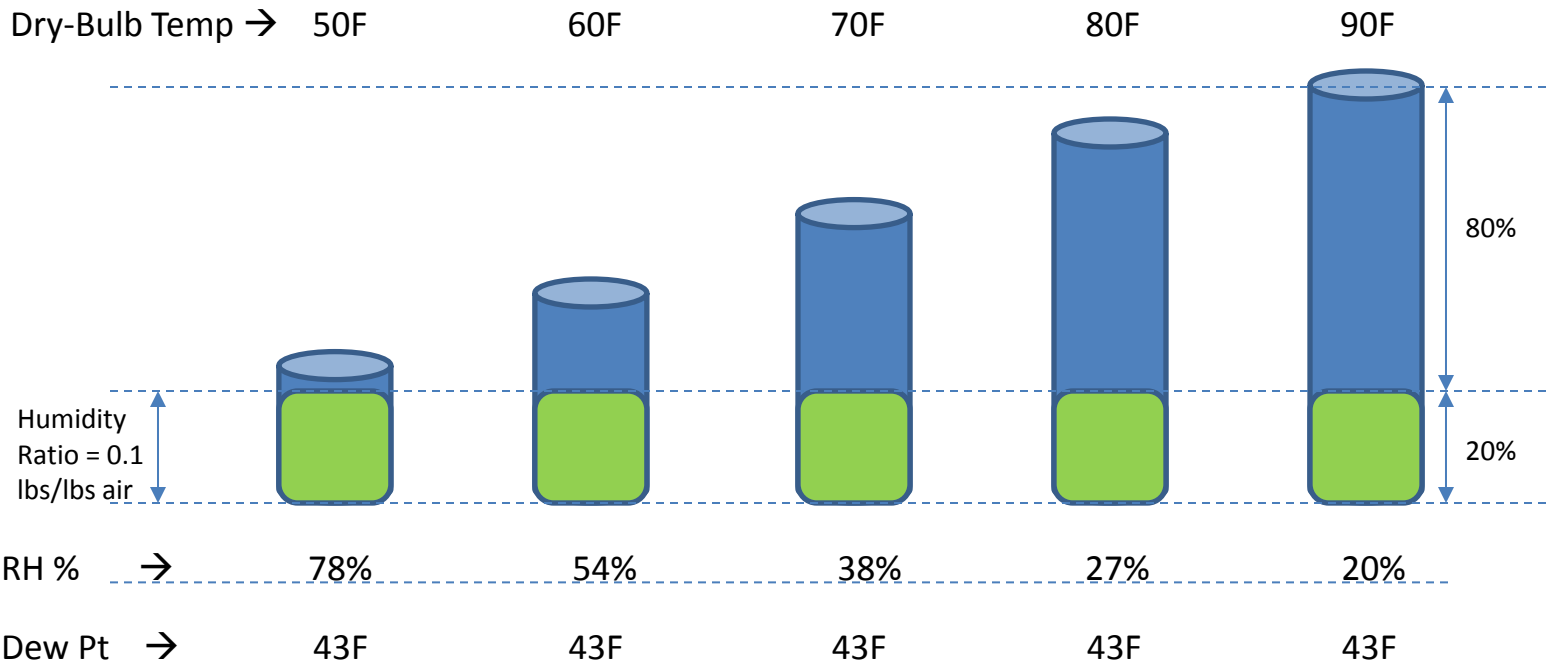
WET-BULB TEMPERATURE. Temperature of air when 100% saturated.

HUMIDITY RATIO. Ratio of water mass to the mass of dry air – ***True indication of amount of water in air.***

RELATIVE HUMIDITY. The amount of water vapor present in air expressed as a percentage of the amount needed for saturation at the same temperature.

DEW-POINT. The temperature below which water droplets begin to condense and dew can form.

Understanding Moist Air Properties

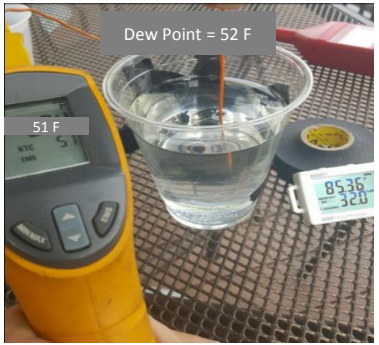


Dew-Point or RH Control?

- Dew-Point is better parameter to control. It does not change with temperature and is an excellent indicator of moisture content in supermarket operations.

- Dew-Point is difficult to measure using sensors, but BMS systems can convert Dry-bulb & RH% to Dew-point.

Understanding Dew-Point



Door Temp needs to be greater than dew-point temperature for no-sweat

What is the Optimum Dew-Point?

- Refrigerated cases are designed for 75F dry-bulb and 55% RH, which is 57F dew-point.
- Human comfort requires 70-76F dry-bulb and 47-57F dew-point temp.

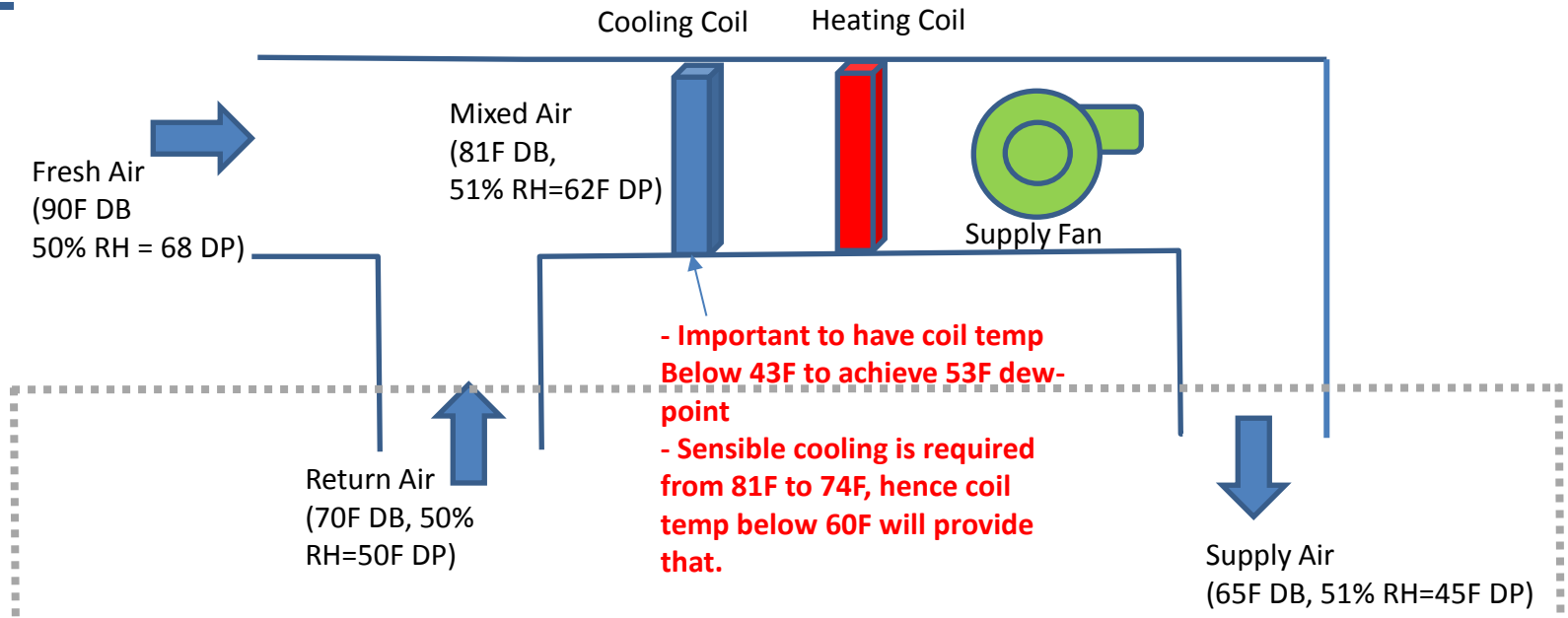
- Lower dew-point is better for refrigerated cases, but may increase HVAC power consumption. There is an optimum dew-point for every store format:
  - Door type and heater amperage
  - Open cases versus closed cases
  - Refrigeration efficiency versus HVAC efficiency
  - % of floor space covered by refrigerated cases

- Start with 74F Dry-Bulb and 51-53F Dew-Point.

Different Methods of De-humidification?

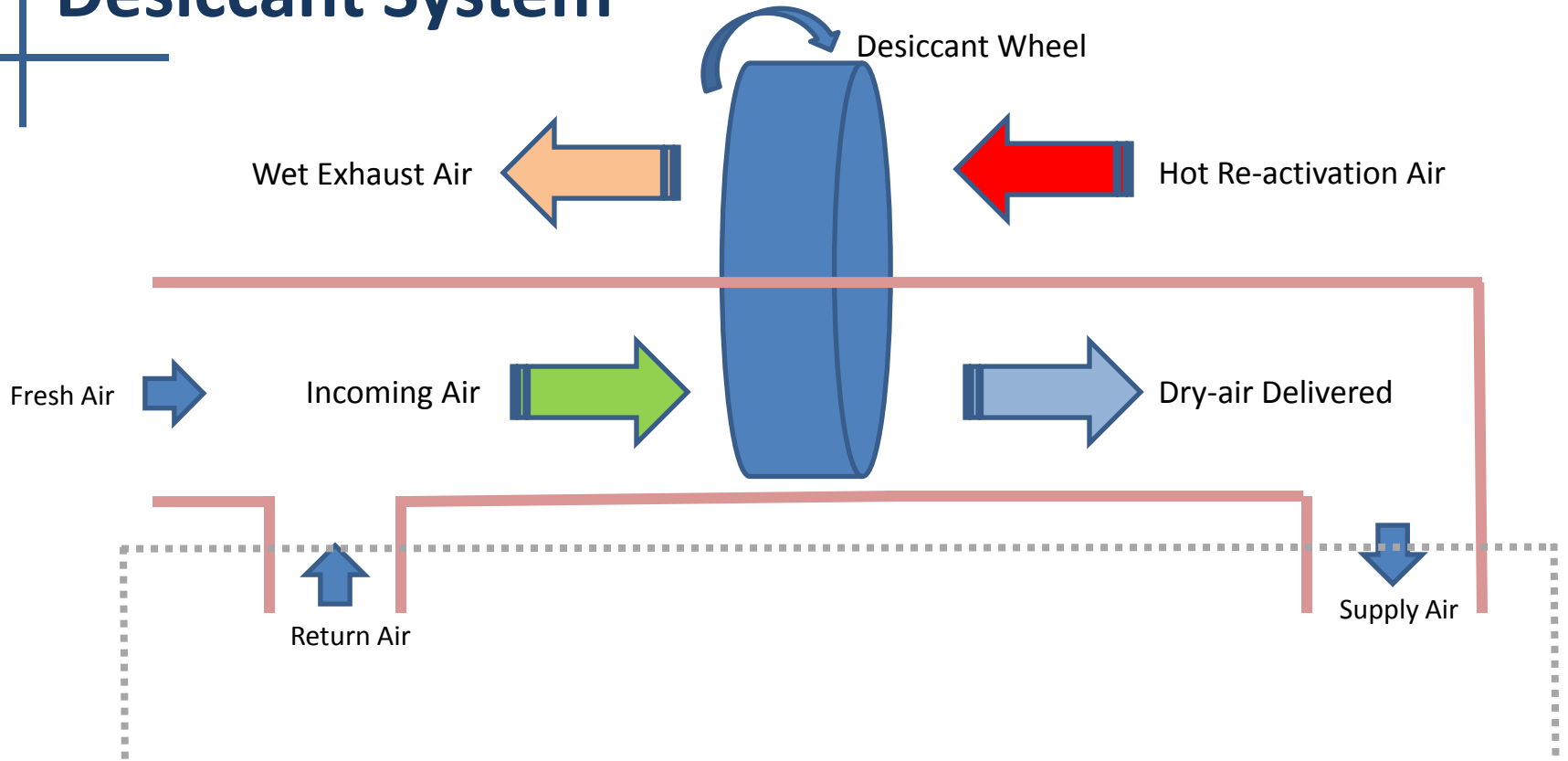
- DX cooling – Latent heat and sensible heat cooling
- Desiccant system
- Combination of above two methods.

DX-Cooling De-Humidification Unit (DHU)

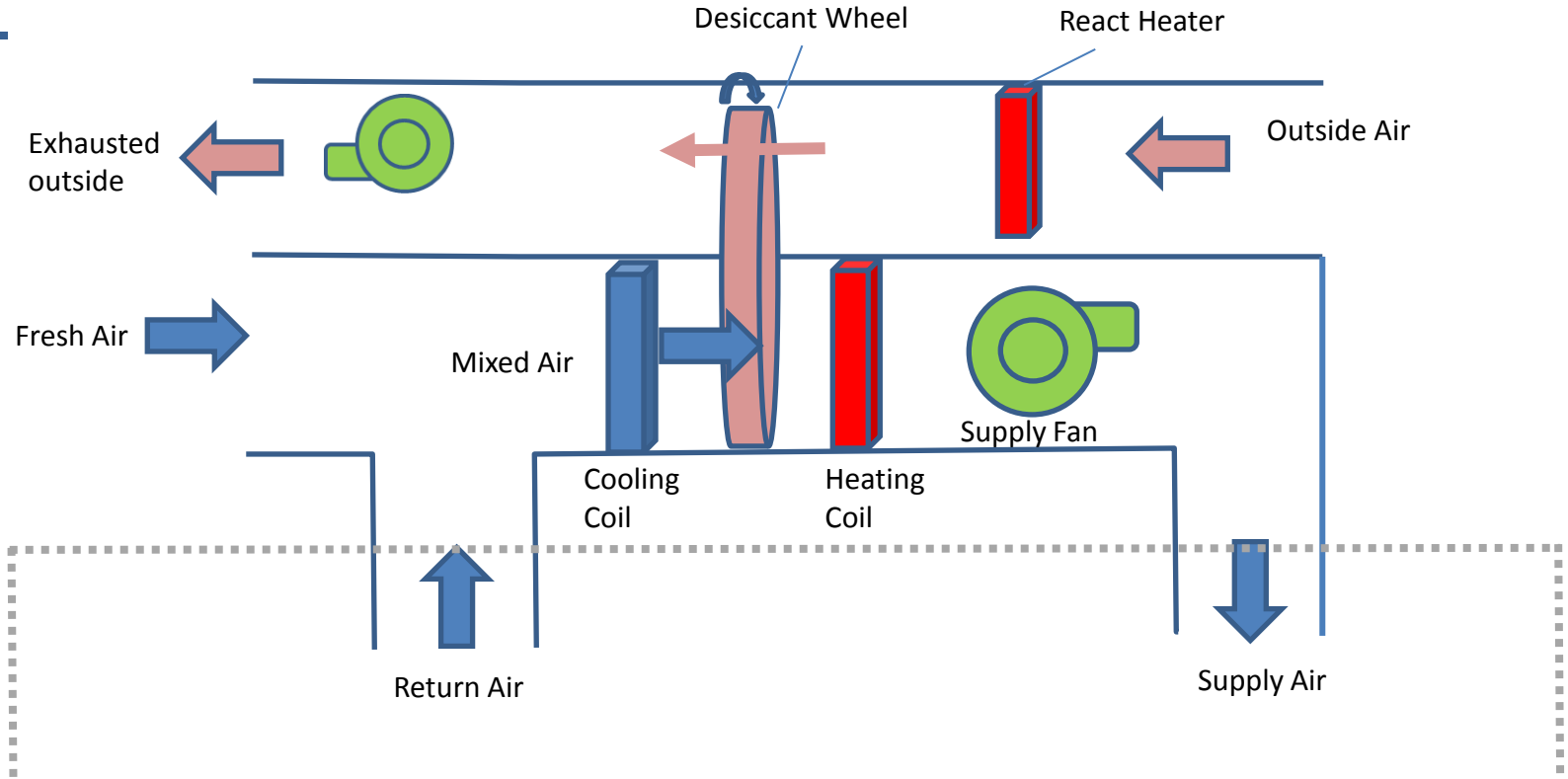


74F Store Temp & 52F Dew Point

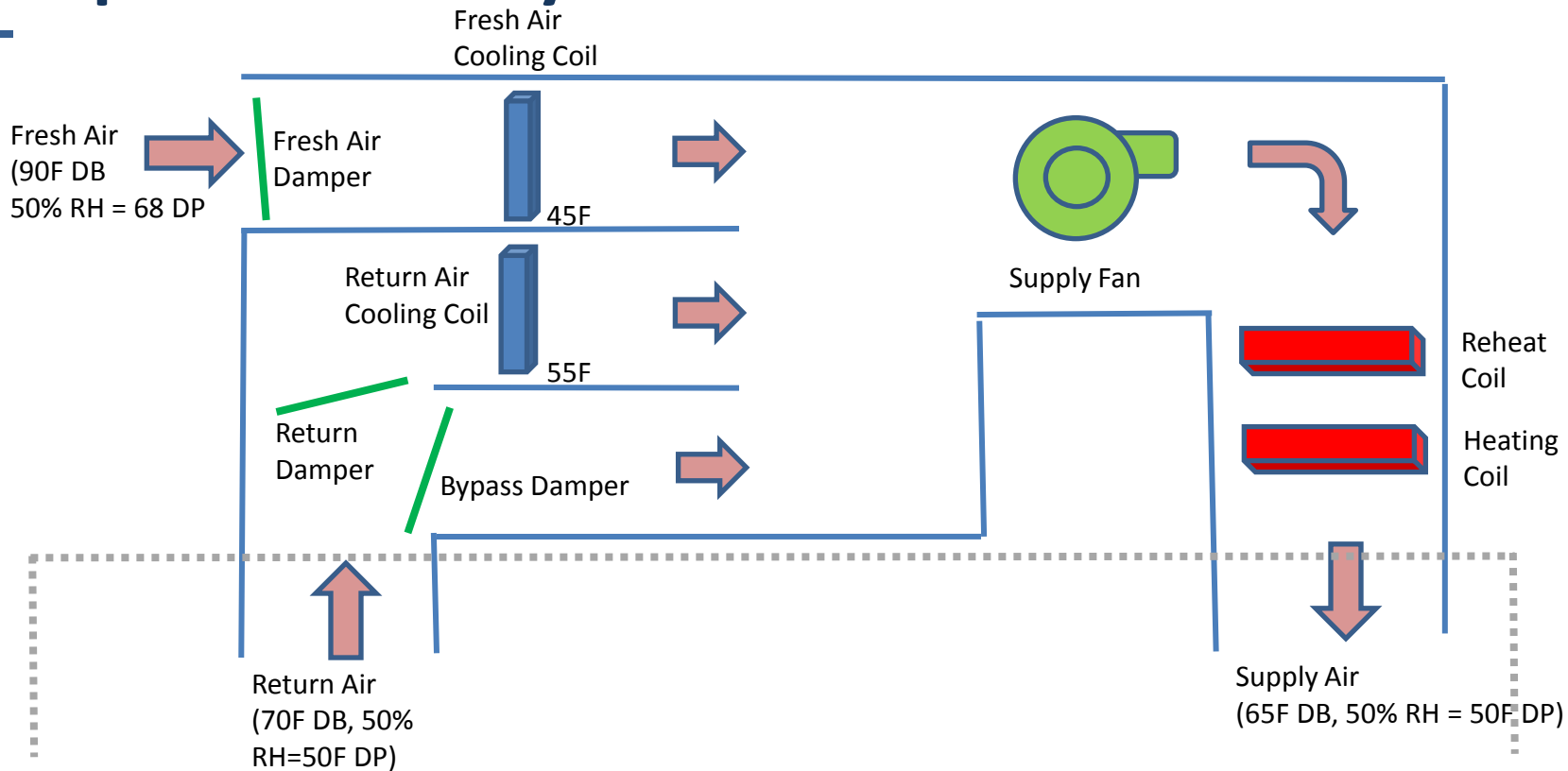
Desiccant System



DX-Desiccant Combination DHU



DX-Separate Path System



What Affects Humidity in Store?

Infiltration:

- Amount of air exhausted needs to be brought through DHU to keep positive pressure; otherwise untreated air will enter from front doors and receiving area.

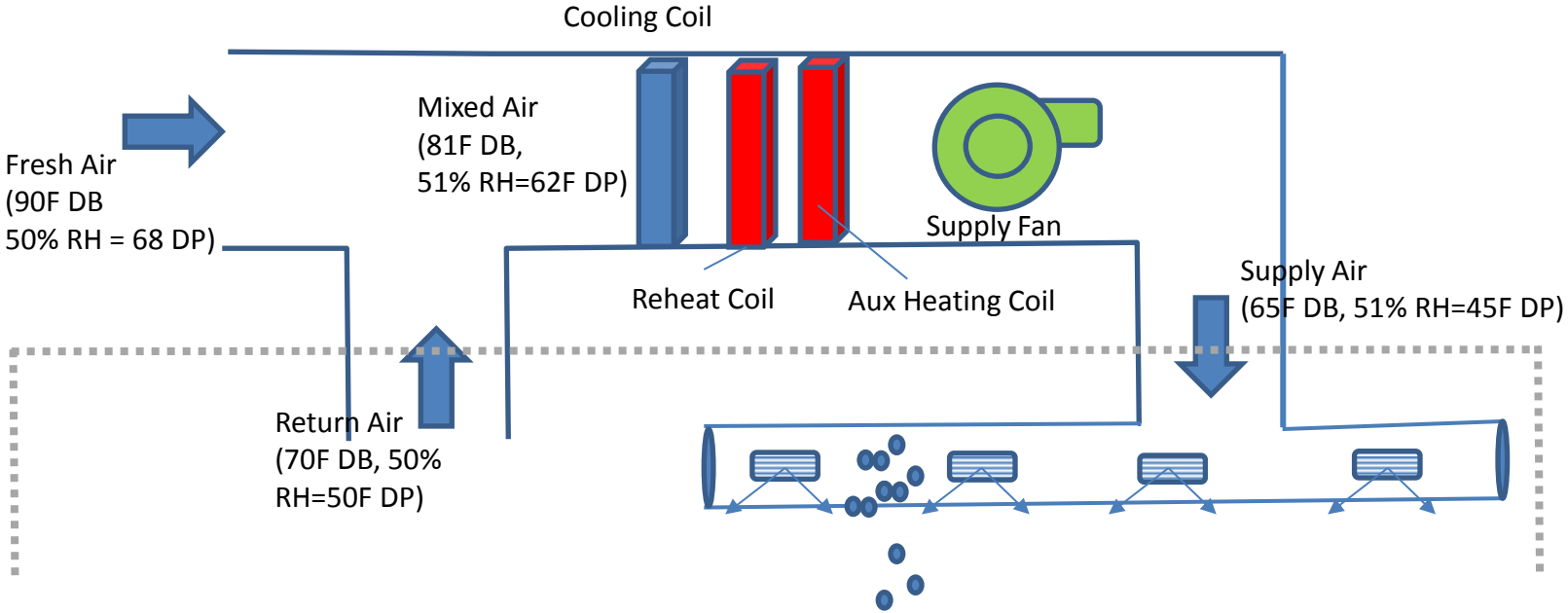
- Watch out compressor rooms if inside the store. If not sealed, the exhaust fans will pull treated air from store, causing negative building pressures.

What Affects Humidity in Store?

DHU Operations:

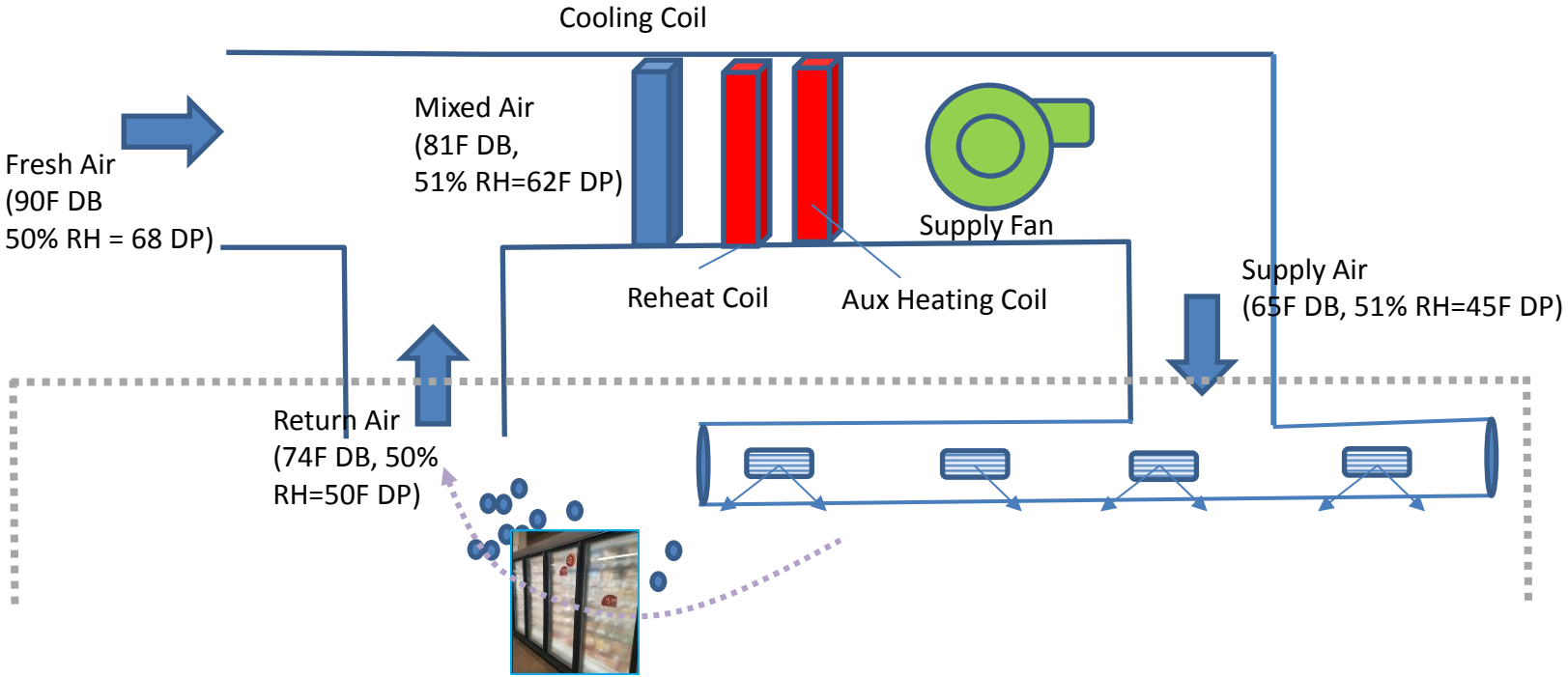
- DHU not working (compressor issue, low charge, TXV off-tuned etc.).
- Night set-back based on moisture control (dew-point), not just time and dry-bulb temperature.
- ON-OFF delays if DX method of DHU.
- Reheat.

Importance of Reheat – Avoid Condensation in Ducts



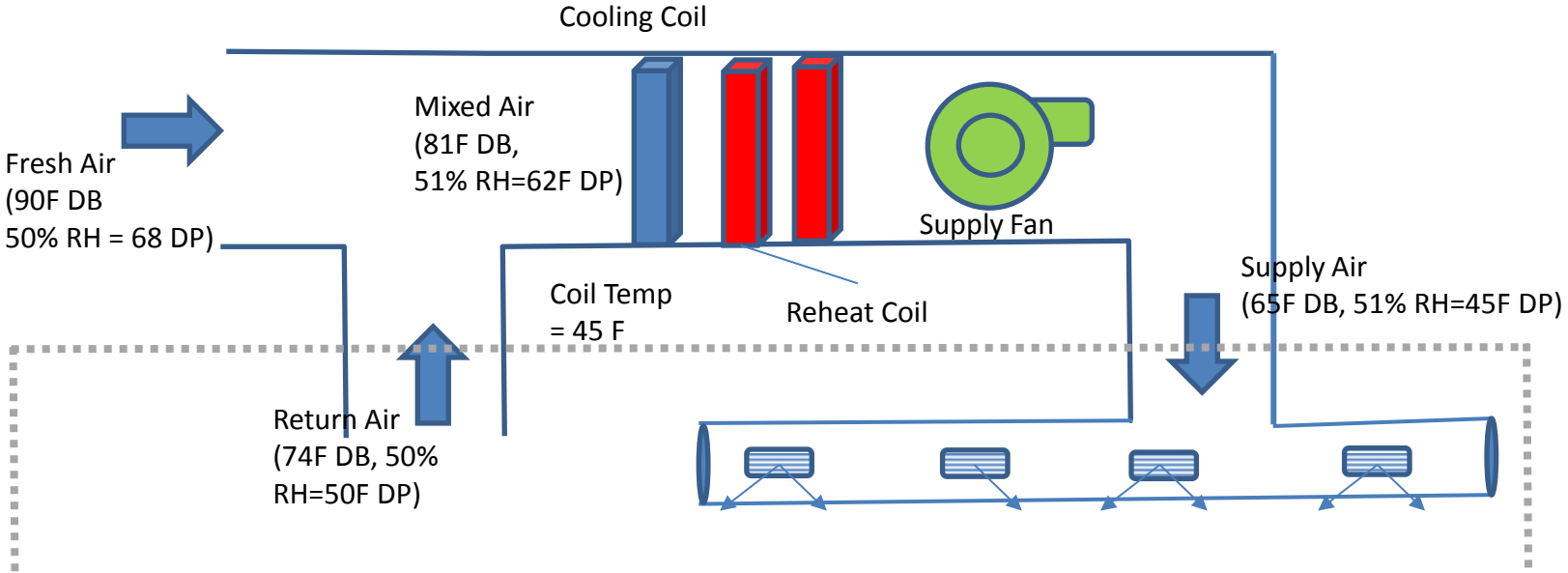
Keep Duct Temperature Above Store Dew-Point to Avoid Condensation

Importance of Reheat – Helps Grab Store Moisture



Store air temperature at 65F can grab less moisture in store than 74F

Importance of Reheat – Helps Remove Moisture



At DX Coil Larger TD (Air DP – Coil Temp) can extract more moisture

How to Diagnose the Humidity Problem?

STEP-1:

- How many doors are sweating?

- If only a few doors sweating, then fix door heaters. Lowering HVAC setting can consume 30-40kW versus fixing 100W heaters.

- If all doors sweating, check if ACHC control is working and set right.

How to Diagnose the Humidity Problem?

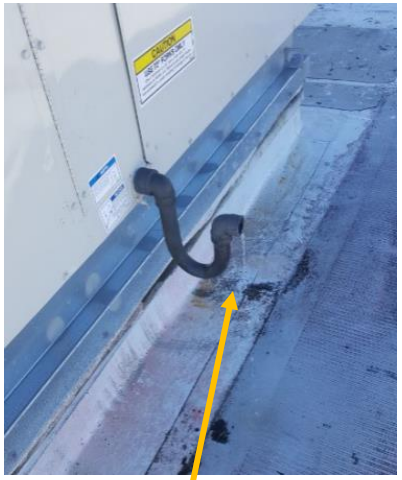
STEP-2:

- Calibrate Temp & Humidity Sensor.
- Calculate dew-point and check if doors that are sweating are above dew-point.
- Refrigerated cases are designed to have temperature above 57F (75F DB and 55% RH).

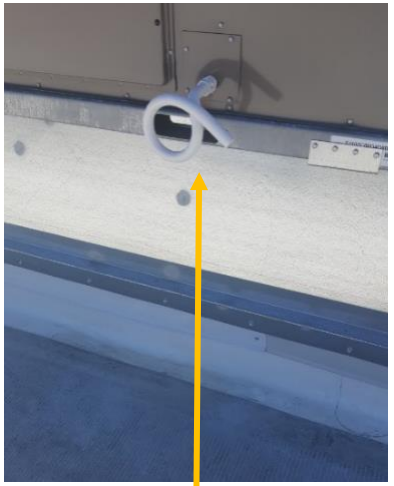
How to Diagnose the Humidity Problem?

STEP-3:

- If Store dew-point > 57 F, then check de-humidification unit P-traps. Is condensate flowing out of it?
- If P-Trap is dry, check evap coil temperatures of DX unit. It has to be below 45F. If not, fix DX unit (low charge, TXV etc.)



Condensate Dripping



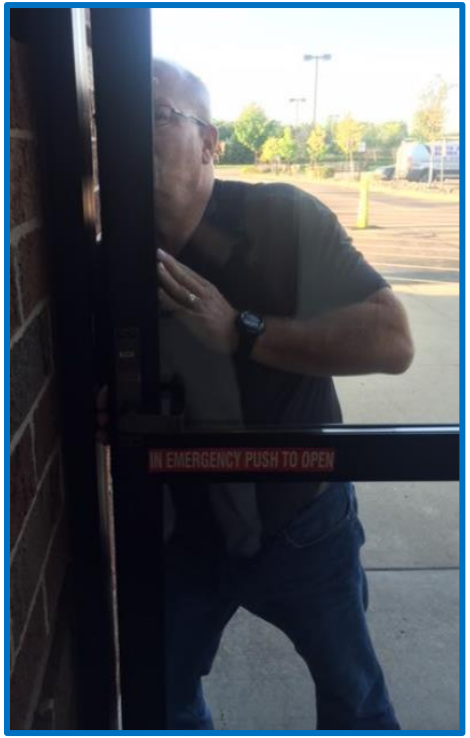
Dry P-Trap

How to Diagnose the Humidity Problem?

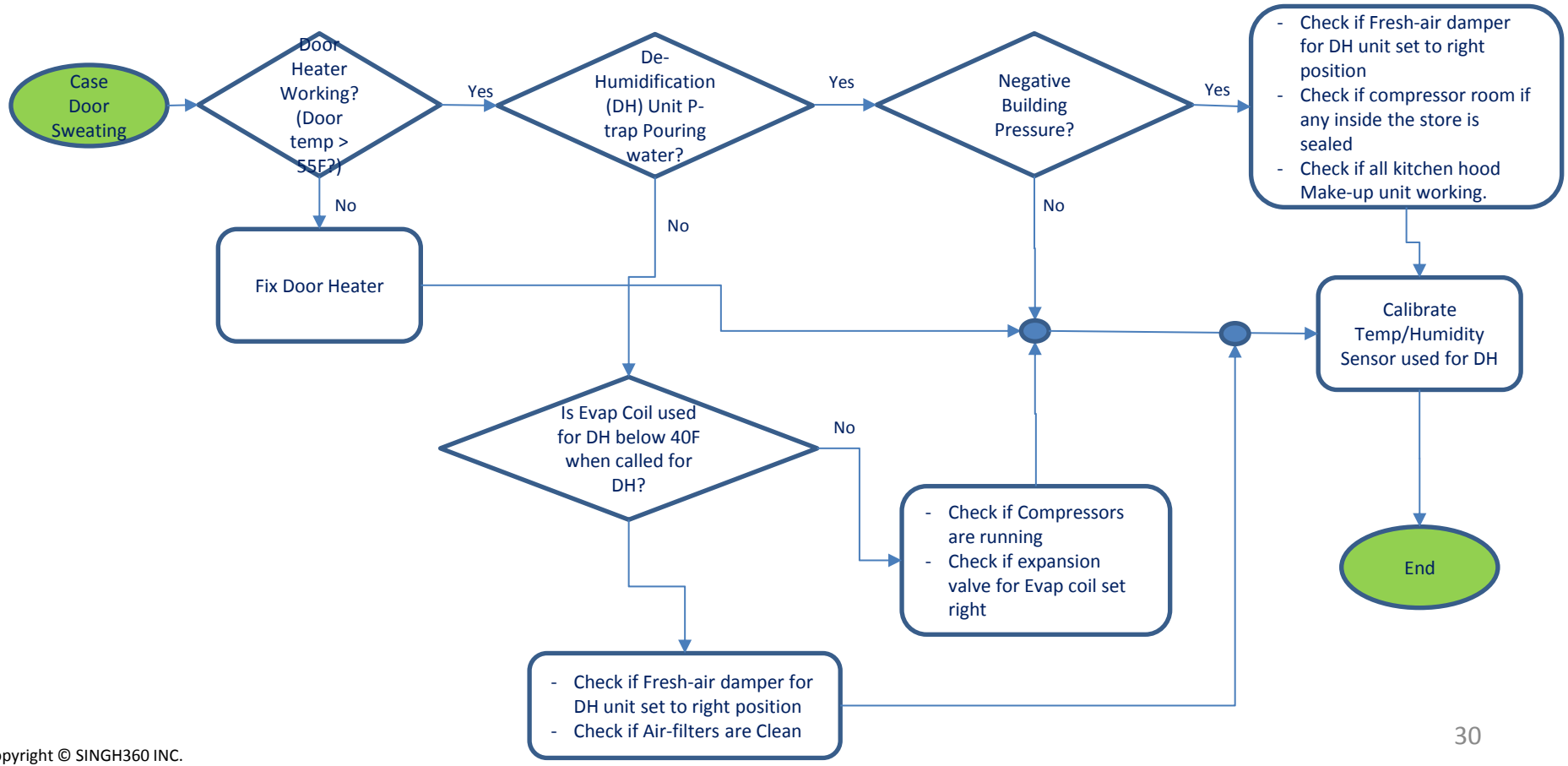
STEP-4:

- Check building pressure (prop open the entry door 0.5” and feel the air-wind direction).

- If –ve pressure, check fresh air dampers control of DHU, make up air units dampers and also check if compressor room (if inside) is fully sealed.



TRIAGING HIGH HUMIDITY CONDITION IN A GROCERY STORE



SUMMARY

- Control humidity using dew-point.
- Control door heaters using dew-point.
- Optimum settings are about 74F DB and 53F DP.
- To keep store humidity under control:
  - Ensure DHU are functioning as designed;
  - Have positive building pressure;
  - Seal compressor room if inside the building;
  - Ensure all make up air for kitchen hood are operating and bringing correct cfm;
  - Deploy reheat, otherwise duct inside the building will sweat;
  - Ensure door heaters are operational.