

DAIKIN McQUAY



Air Systems Design

Coils



What you will Learn in this Lesson

- Coils vs. fin tubes
- Heat transfer
- Coil circuiting
- Row split vs. face split
- Coil selection tips

Coils

- Coils are heat exchangers
- They warm air or cool air
- The source fluid is steam, water, or refrigerant

Fin Tubes

- Natural convection
- Used in perimeter radiation
- Used in convectors

Heat Transfer Resistance

- Inside resistance (R_1)
- Tube resistance(R_2)
- Outside resistance (R_3)

Coil Components

- Fin Options
- Materials - Aluminum or Copper
 - Base selections on thickness and material
- Fin spacing - establishes amount of airside heat transfer surface
 - Increasing fins per in² (FPI) increases performance & pressure drop
- Corrugation - turbulence of airflow
 - Highly corrugated (“C” fins), mildly corrugated (“B” fins) and flat fin (“A” fins)
 - Variations provide multiple options to balance performance, pressure drop and cost

Heat Transfer

- The transfer of heat between the cooling fluid and the airstream is influenced by the following variables:
 - Temperature difference between the fluid and the air
 - Design and surface arrangement of the coil tubes and fins
 - Velocity and character of the airstream
 - Velocity and character of the fluid in the tubes
- The heat transfer performance of both heating and cooling/dehumidifying coils can be described mathematically

Log Mean Temperature Difference DX

$$q = U \cdot A \cdot \Delta T_{\text{mean}}$$

Where

q = heat flow rate (Btu/hr)

A = area available for heat transfer (ft²)

U = overall heat transfer coefficient (Btu/h·ft²· F)

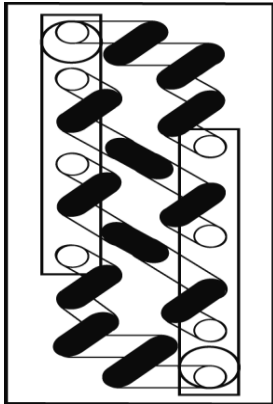
ΔT_{mean} = mean temperature difference (F)

- For ΔT_{mean} , the **LMTD** is used

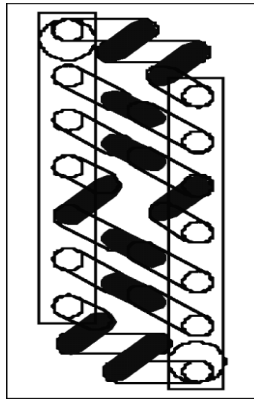
$$\Delta T = \frac{(T_{a1} - T_{r2}) - (T_{a2} - T_{r1})}{\ln_e \frac{(T_{a1} - T_{r2})}{(T_{a2} - T_{r1})}}$$

Coil Circuiting - Water

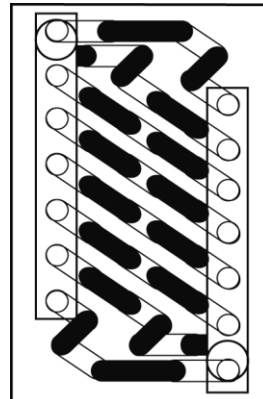
- Coil Circuiting Arrangements



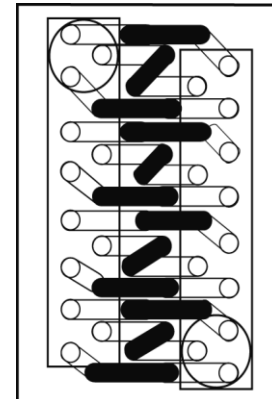
5WH
1/2 Serp (H)



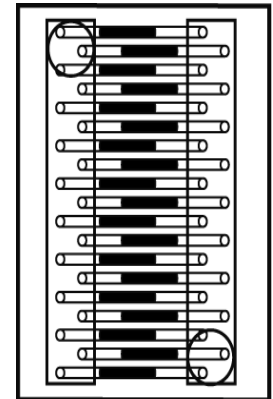
5WL
3/4 Serp (L)



1 (single) Serp (M)



5WM
1-1/2 Serp (M)



5WD
2 (double) Serp (D)

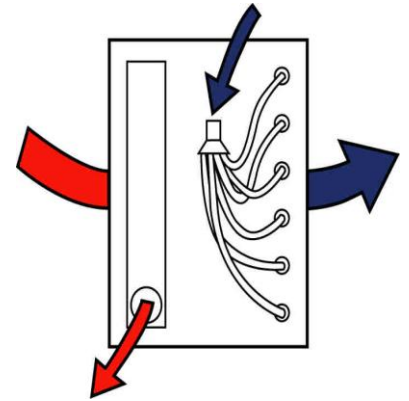
Turbo Spirals - Brass Springs Inserted In Tubes To Enhance Performance. Can Save As Much As 2 Rows Of Surface On Glycol Concentrations Of 30% Or More. Not Recommended For Water Applications.

Coil Circuiting - DX

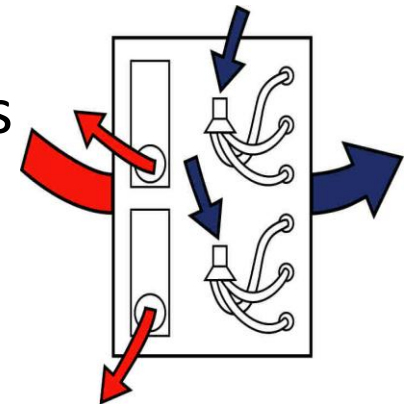
- Evaporative (DX) Coil Circuiting
 - Coils May Be Split Into Two or More Circuits For Capacity Reduction - Splits Should Be Compatible With Condensing Units

Coil Circuiting - DX

- Normal Face
 - One distributor & one suction connection

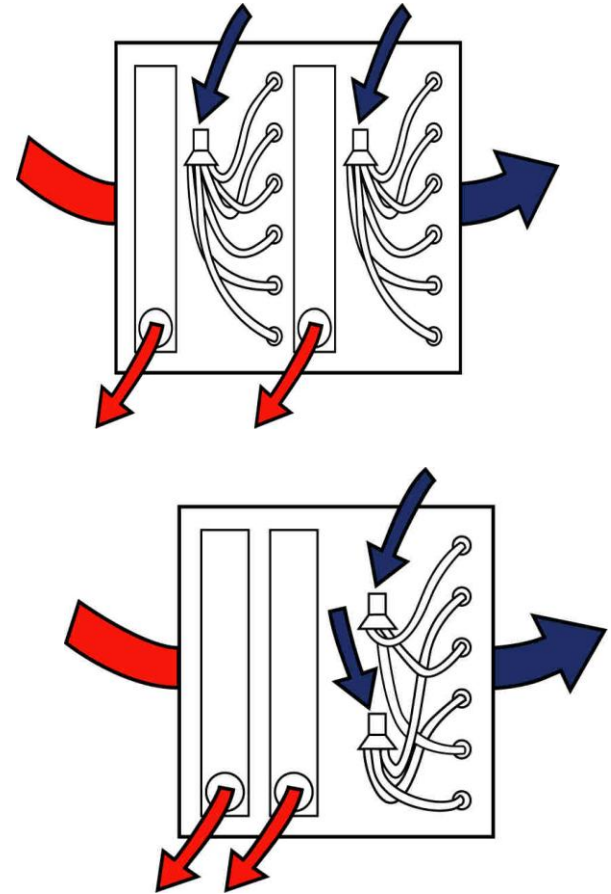


- Face Split
 - Two distributors & two suction connections
 - Stratification may occur



Coil Circuiting - DX

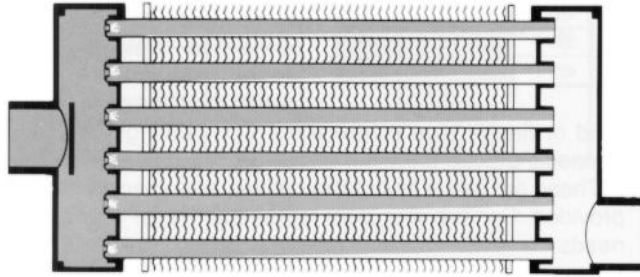
- Row split
 - Two distributors & two suction connections
 - Reduces stratification by incorporating entire face of coil on each circuit
- Interlaced
 - Two distributors & two suction connections
 - Incorporates both face and depth of coil in each circuit.
 - Most efficient way to split a coil and best humidity control



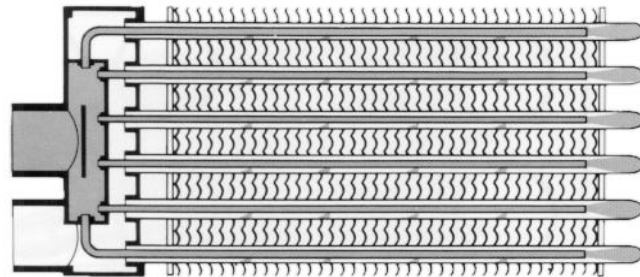
Coil Circuiting - Steam

- Standard Construction
 - Utilize copper tubes and headers
 - Coils rated to 150 psi, But high pressure coils are recommended for pressures above 25 PSIG
- High Pressure Construction
 - Utilize cupro-nickel tubes and headers rated to 350 psi
- Distributing Tube
 - The tube within a tube provides superior freeze resistance

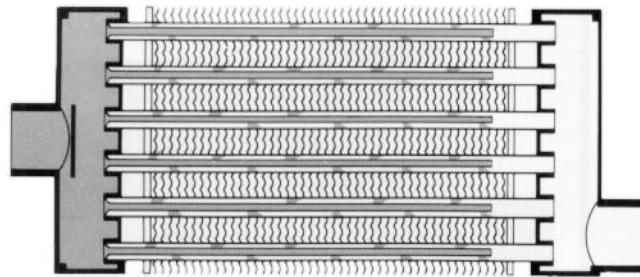
Coil Circuiting - Steam



**5SA & HA
General Purpose
Steam Coils**



**5JA, 8JA, 5GA & 8 GA
Jet Tube Distributing Coils**



**8 RA & 8 TA
Opposite End Connection Coils**

Control Valves: the coil's partner

- Control valves for cooling coils need two features:
 - Shut off head sufficient to close when needed
 - A Cv that meets the load without hunting
- Valve actuators can be undersized.
 - Actuator close-off rating is the max diff pressure the valve will close
 - Dynamic close-off pressure is the max diff pressure the valve will modulate
- Don't oversize the valve, don't use 3-way on variable flow (except for chiller minimum flow), size actuator correctly for dynamic close-off.

Low Delta T: Is it the coil's fault?

LAT Setpoint	Water Flow	Delta-T
54	80	13
53	104	11
52	143	8.5
51	208	6.5
50	327	4.3
49	Not possible	
Six Row 8 fpi 78°F/63°F EAT		

Low Delta T: Is it the coil's fault?

ECHWT	Water Flow	LCHWT	Delta-T
42	30	58.7	13
44	34.5	58.7	11
46	41	58.3	8.5
48	53	57.5	6.5
Eight Row 8 fpi 77°F/62°F EAT 55°F LAT			

End of Lesson

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