S I R A C H

The applications of micro channel heat exchangers - the practical application in chillers & condensing units

Johan Rissler
HX Business Development Manager
(johan.rissler@danfoss.com)
Danfoss

sirach
www.sirach.org.uk

New legislation to reduce environmental footprint of chillers

Direct GWP Impact

- **Switch to low GWP refrigerants (F Gas Regulation)**
- **Reduction in Charge**
  - Large portion of charge in chillers is in the heat exchangers
  - Compact low charge heat exchangers

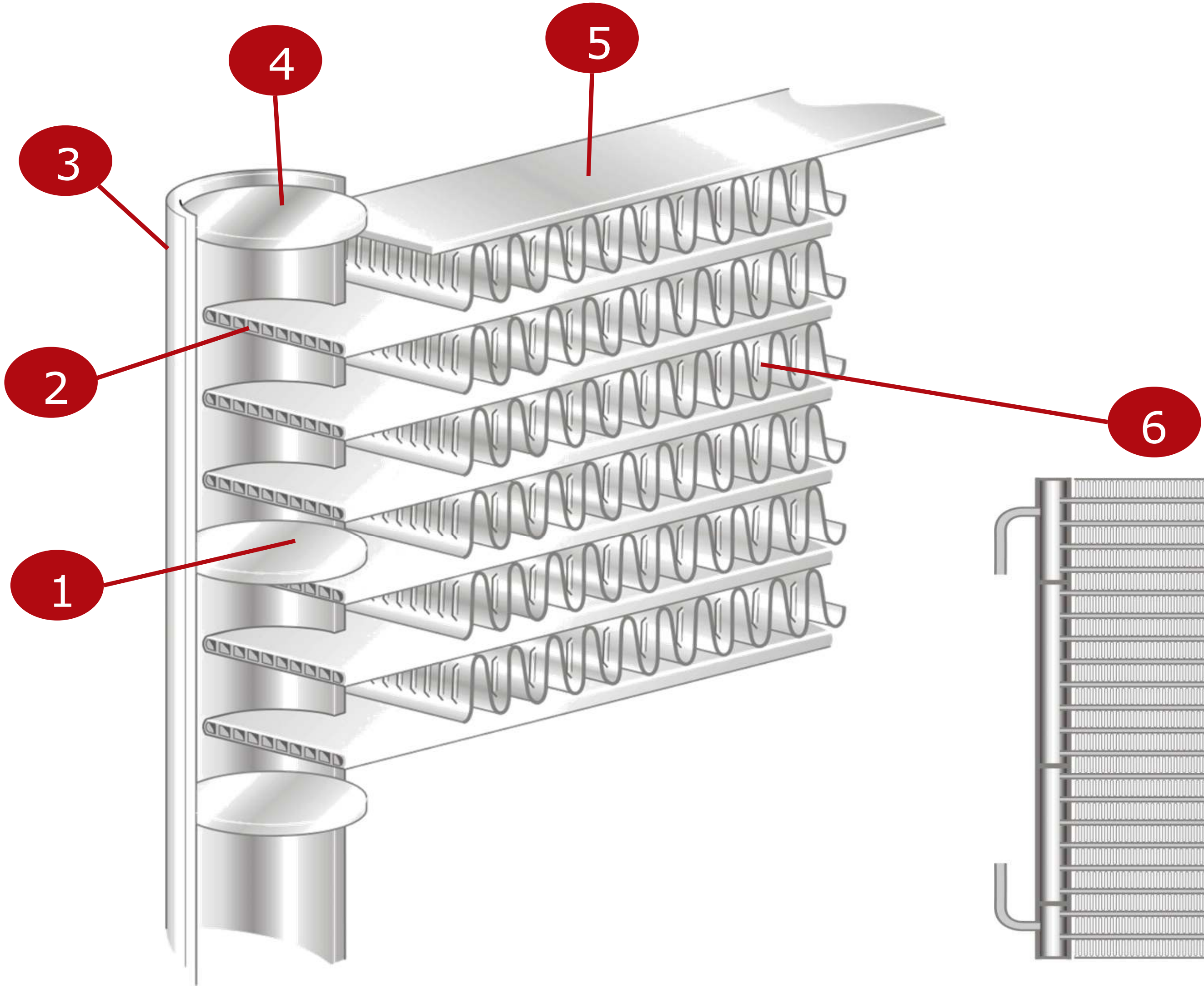
Indirect GWP Impact

Reduce Energy Consumption

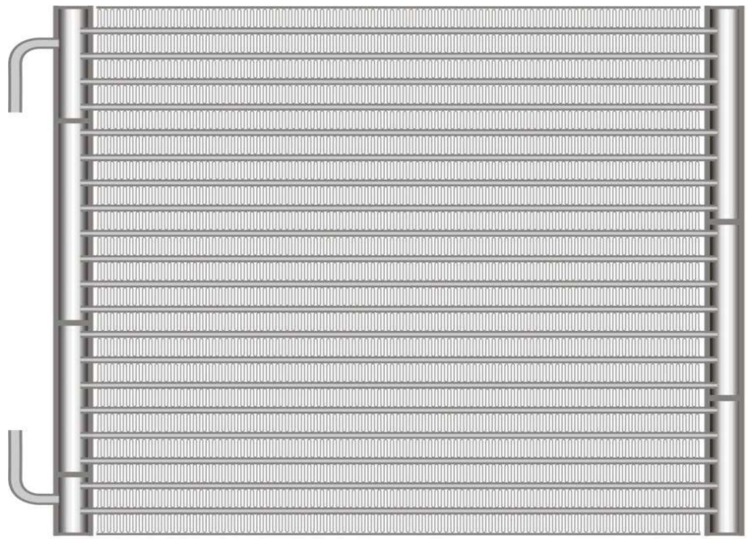
- **ASHRAE 90.1 / Ecodesign Europe**
  - Variable Speed Drives
  - High Efficiency Compressors/Motors
  - More Efficient Heat Exchangers

High Efficiency Micro Channel Heat Exchangers can help address these challenges

Micro Channel Heat Exchanger



1. Baffle
2. Tube with microchannels
3. Header
4. End cap
5. Side plate
6. Fins



Why Micro Channel Heat Exchanger?

Higher Capacity and Efficiency

Lower Condensing Temperature

Reduced Compressor Power

Increased Compressor Envelope

Less Air Pressure Drops (same capacity)

100%
Aluminium

Strong mechanical design

No galvanic corrosion

70%
Less refrigerant charge

Up to 70% less for condenser

100%
Aluminium

Lower material price volatility

Easy recycling

50-70%
Weight reduction

Savings in transport & installation costs

Same size-better performance

Same performance-smaller size

MCHE vs F&T example Air-Cooled Chiller

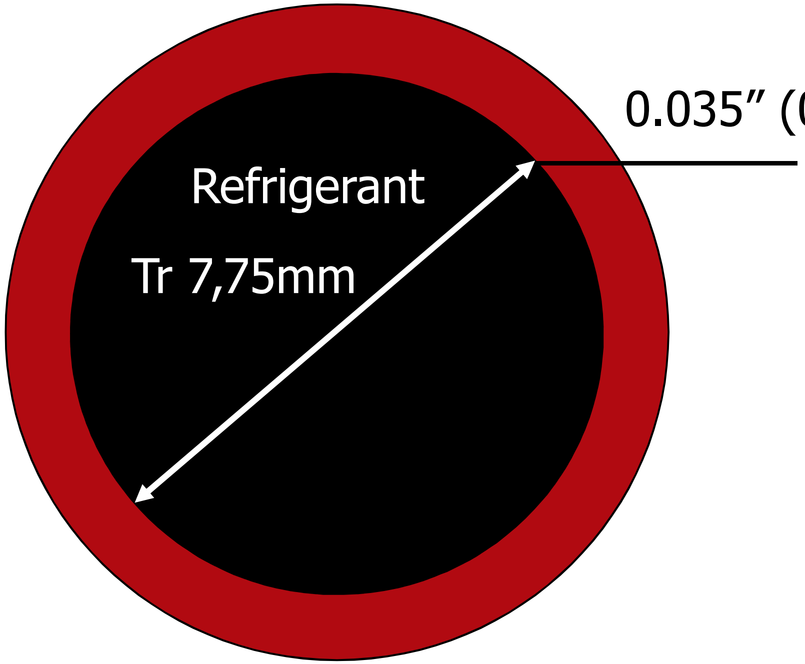
	MCHE	F&T	Difference absolute	Difference relative
Weight, kg	**29.7**	**92.4**	**62.7**	**-68%**
Hold-up volume, l	**8.1**	**35.3**	**27.2**	**-77%**
Space, dm^3	**62** (25x1200x 2050 mm)	**270** (110x1200x 2050 mm)	**208**	**-77%**

Design Conditions:

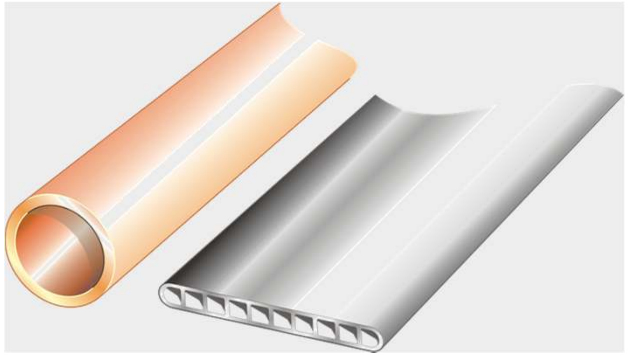
R410A, Capacity 90 kW, Tc = 50 °C, SC = 5 K

Air temp: 35 °C/RH 50%, Air velocity: 2.6 m/s

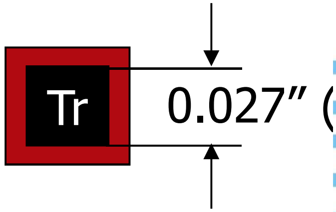
MCHE vs. Fin & Tube design

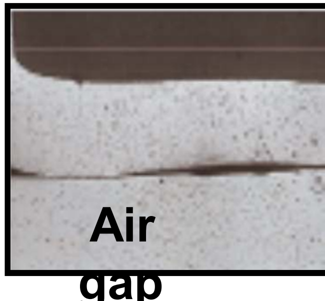


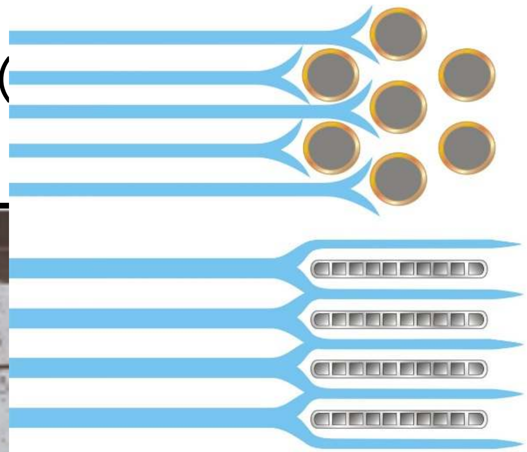
3/8” Tubing



Microchannel





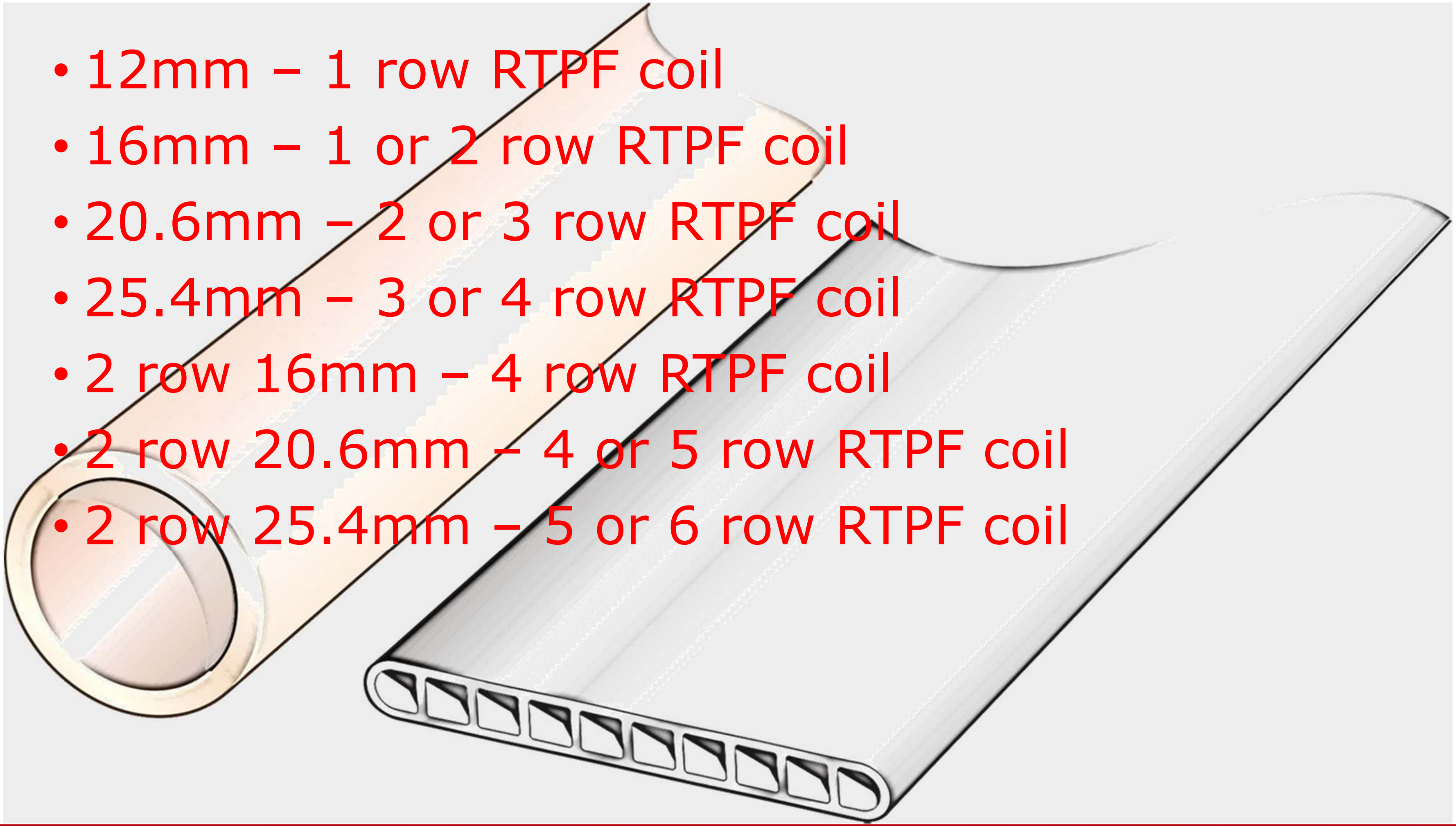


MCHE heat transfer improved by:

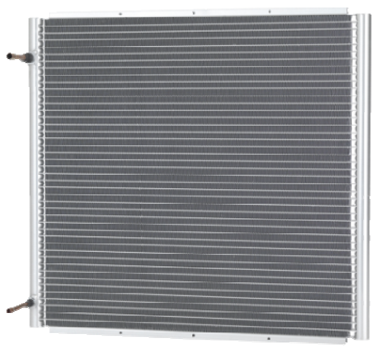
- **Reduced refrigerant side hydraulic diameter = more surface contact**
- **Reduced wall & contact resistance between tubes and fins (no air gaps)**
- **Reduced air side flow resistance on primary heat exchanger surfaces (less wakes & vortex shedding). This also reduces noise.**

MCHE Equivalents to Rows of Tube & Fin

- 12mm – 1 row RTPF coil
- 16mm – 1 or 2 row RTPF coil
- 20.6mm – 2 or 3 row RTPF coil
- 25.4mm – 3 or 4 row RTPF coil
- 2 row 16mm – 4 row RTPF coil
- 2 row 20.6mm – 4 or 5 row RTPF coil
- 2 row 25.4mm – 5 or 6 row RTPF coil



Applications



Chillers

Residential AC

Commercial split roof tops

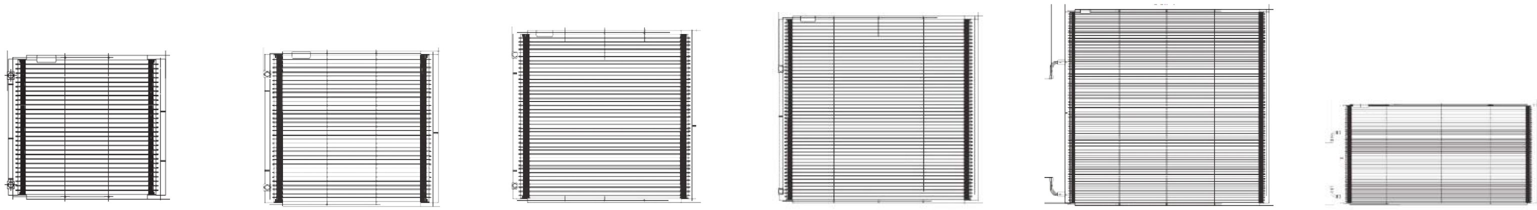
Condensing units

Air driers

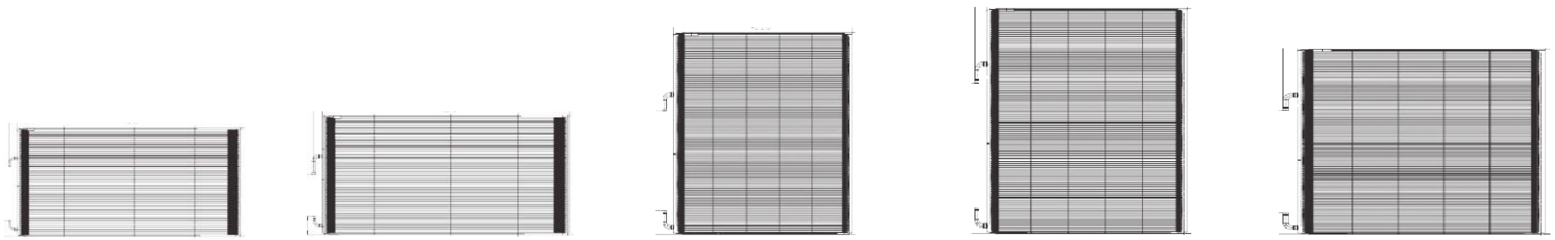
Cabinet cooling

Indoor display

Product overview - Standard D-range MCHE



Product Name	D1000-C	D1100-C	D1200-C	D1300-C	D1400-C	D1500-C
Size, mm	332x300	387x347	462x432	552x517	780x771	974x517



Product name	D1600-C	D1700-C	D1800-C	D1900-C	D2000-C
Size, mm	1280x623	1324x639	1074x1212	1274x1363	2000x1058

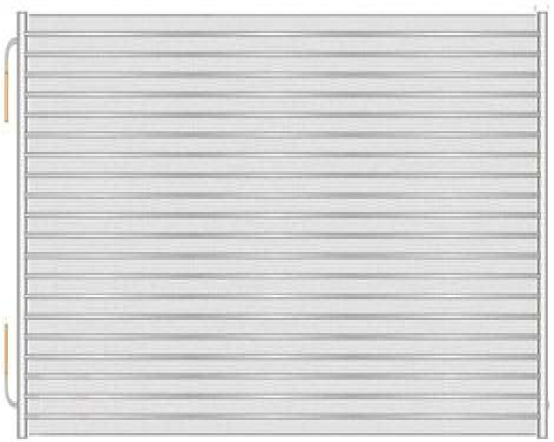
MCHE Condenser Ready solutions

Model	Type	Size		Capacity, kW					
				Commercial AC/Chillers		Condensing units	Air dryers	Cold room	Cabinet cooling
				ΔT= 12 K v_{air}=2,5 m/s		ΔT=12 K v_{air}=3 m/s	ΔT=15 K v_{air}=3 m/s	ΔT=12 K v_{air}=2,5 m/s	ΔT=12 K v_{air}=2,7 m/s
				ARI		CECOMAF			
		Height	Length	R134a	R410A	R407F	R134a	R407F	R407F
D1000-C	2G16-23 FPI	301	330			1,8	2,3	1,5	1,7
D1100-C	2G16-23 FPI	348	385			2,3	3,2	2,0	2,2
D1200-C	2G16-23 FPI	432	460			3,7	4,9	3,2	3,4
D1300-C	2G16-23 FPI	517	550			5,1	7,1	4,4	4,8
D1400-C	2G16-23 FPI	771	800	10,6	12,0			10,8	
D1500-C	2G25-23 FPI	517	1074	12,7	14,6				
D1600-C	2G16-23 FPI	639	1300	14,4	18,5				
D1700-C	2G25-23 FPI	639	1324	20,0	24,5				
D1800-C	2G25-23 FPI	1213	1074	30,9	35,2				
D1900-C	2G25-23 FPI	1363	1274	41,6	51,2				
D2000-C	4G25-23 FPI	1058	2000	54,4	62,2				

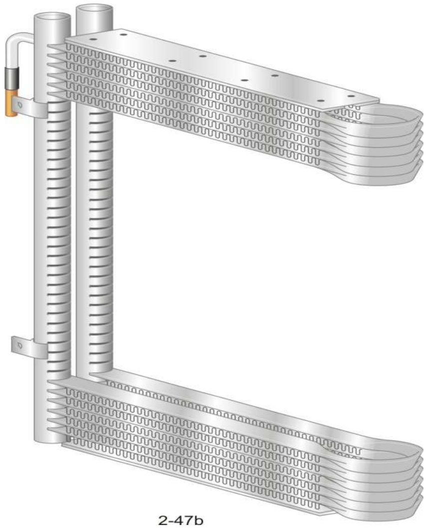
ARI Ambient 35° C, HBP (Tevap 5° C), 10 K superheat, 5 K subcooling

CECOMAF Ambient 32° C, MBP (Tevap -10° C), 10 K superheat, 0 K subcooling

Basic Configurations



Flat coil (condenser)



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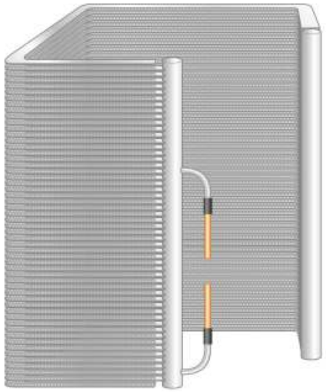
Folded – two row coil

3-2

Bent coil (condenser)



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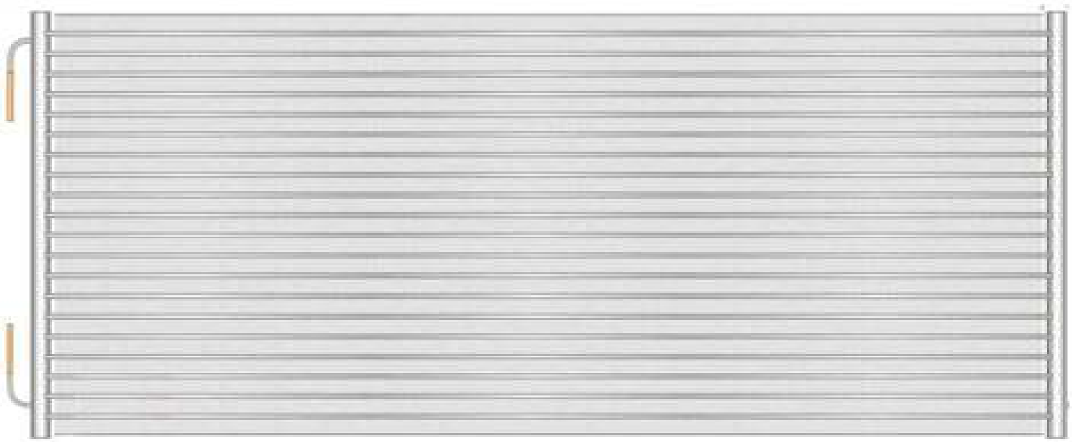
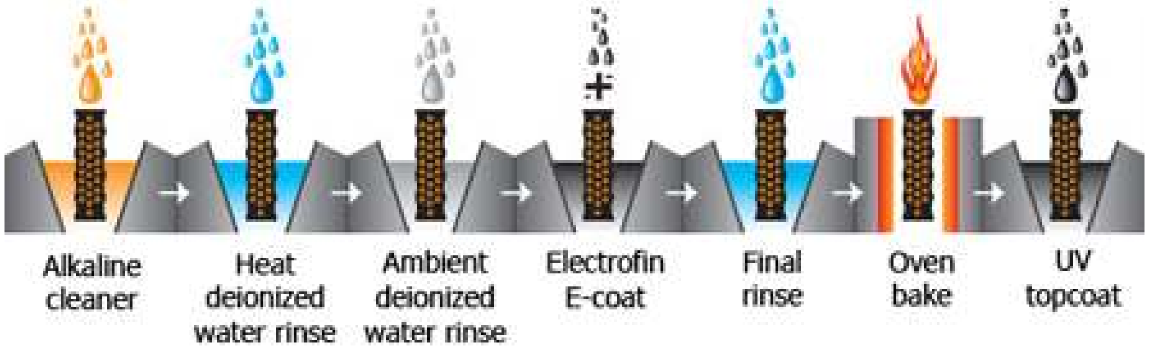
Coil Aspect Ratio

- MCHE is more competitive when the ratio of MPE tube length / header height is high
- Less competitive when MPE tube length / header ratio is low
  - Higher header cost for given face area
  - More flow area blocked by headers
  - More passes / baffles for condenser

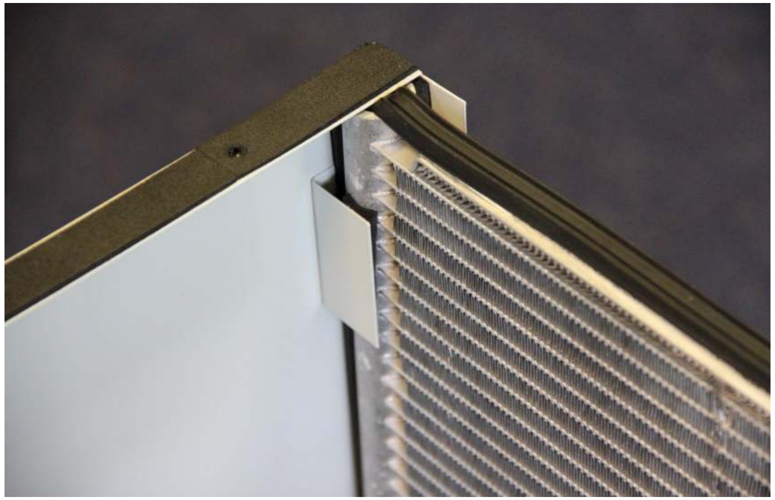


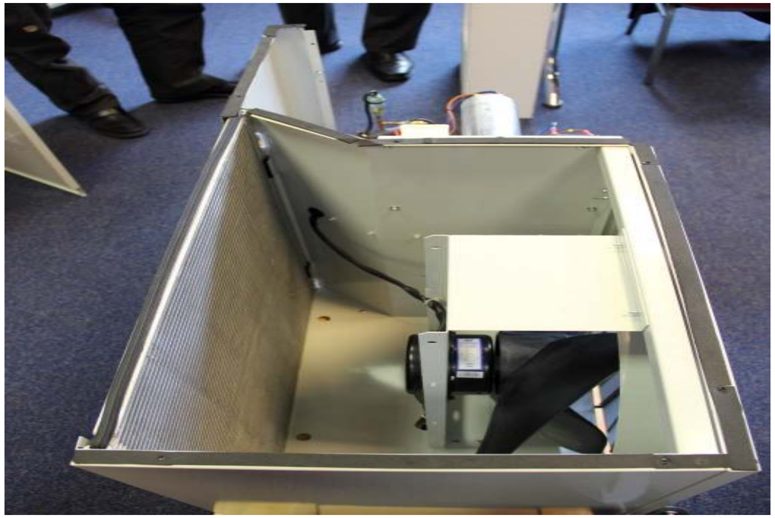
Coil Coating

- E-Coat (electrostatically applied epoxy coating) and UV topcoat
- Very thin film black colour
- 100% coverage
- Only 1% heat transfer degradation
- If current application is Cu/Cu FT coil or e-coated FT coil then MCHE requires e-coat as well
- Applications on or near sea side
- Corrosion tested “SWAAT"ASTM G85 A3 for 2400 hours



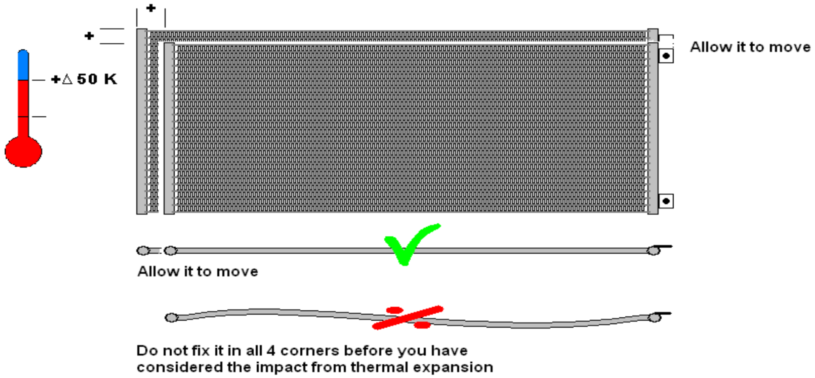
MCHE coil assembly (Condensing unit)



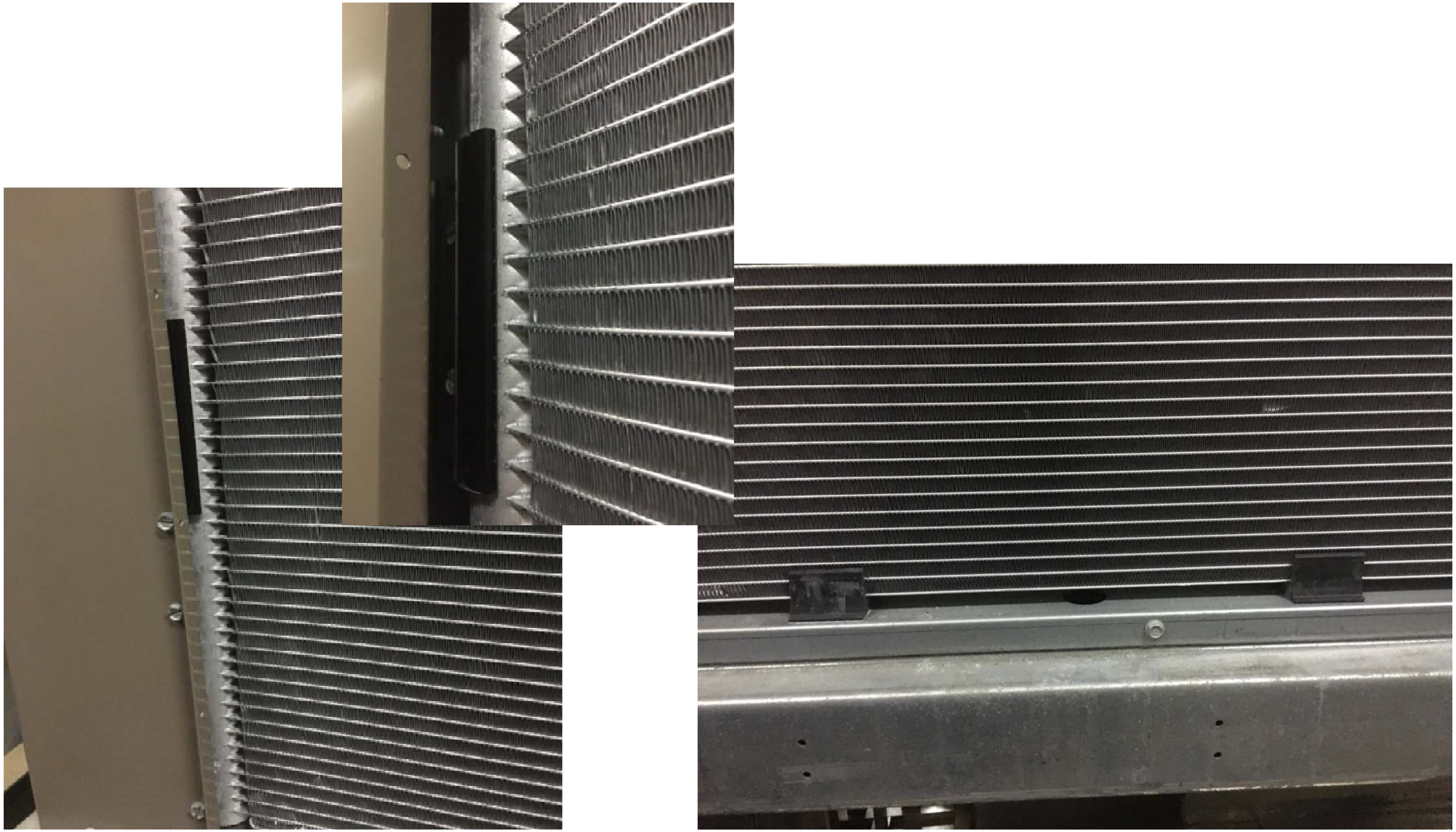


- Allow for thermal expansion
  - Al thermal expansion coefficient 23E-06 1/K

- Eliminate contact with dissimilar metal
  - Risk of galvanic corrosion
  - Top and Bottom Side Plates – Use rubber/foam shoes or padding
  - Brackets – Use rubber/plastic washers/grommets



Example MCHE coil in Chiller



ENGINEERING
TOMORROW