Steam Coils

Heatcraft® heat transfer coils

by LUVATA

Contents and Nomenclature

Nomenclature

5 SA 12 01 C 24.00 x 144.00

5 = Tube O.D.
SA = Coil Type
12 = Fins Per Inch
01 = Rows Deep
C = Fin Design
24.00 = Fin Height (in)
144.00 = Finned Length (in)

Tube Outside Diameter
5 = 0.625” or 8 = 1”

Coil Type

5JA,	8JA:	Distributing tube, same end conn
5GA,	8GA:	Distributing tube, same end conn (high pressure)
5DA,	8DA:	Distributing tube, dual supply, opp end conn
5LA,	8LA:	Distributing tube, dual supply, opp end conn (high pressure)
5RA,	8RA:	Distributing tube, opp end conn
5TA,	8TA:	Distributing tube, opp end conn (high pressure)
5SA,	8SA:	Single tube, opp end conn
5HA,	8HA:	Single tube, opp end conn (high pressure)
	5SB:	Single tube, opp end conn, 3” center-to-center
	5HB:	Single tube, opp end conn, 3” center-to-center (high pressure)
	5SS:	Single tube, same end conn
	5SH:	Single tube, same end conn (high pressure)

Fins Per Inch - 4 to 24
Rows - 1 to 12 (Consult factory for rows > 12)
Fin Design

A - flat (Al, Cu)	F - flat (SS, CS)
B - corrugated (Al, Cu)	G - corrugated (SS, CS)
C - sine wave (Al, Cu)	H - sine wave (SS, CS, Al, Cu)
D - raised lance (Al) 3/8 only	

Fin Height - minimum of 6 inches to a max of ???
Finned Length - minimum of 6 inches to a max of ???

Distributing Coil Types

Steam distributing, jet tube, coils are excellent for any general purpose heating applications. With the superior freeze resistance provided by the tube-within-a-tube construction, they are ideal for low temperatures, preheating, and process applications. Although the steam distributing design is more resistant to freezing, it is not freeze proof. No manufacturer can accurately claim to have a freeze proof coil. Figures 1, 3 and 5 feature distributional orificed inner tubes, Figures 1 and 3 feature a unique elliptical supply header located inside the heavy-duty return header, and a circuiting arrangement which provides for supply and return connections at the same or opposite end of the coil. The distributional orifices properly meter steam along the entire tube length to assure a consistent temperature rise across the full coil face and accelerate condensate removal, providing a more uniform air temperature rise than the non-distributing design.

Model Types - JA and GA (Figure 1), offer same end supply and return connections. When made as same end connected, the header appears as a single large header, but is actually two headers in one. Steam is fed from one direction while the condensate travels in the opposite direction. The JA coil is built with copper tubing for low pressure applications. The GA coils utilize cupro-nickel, admiralty brass, carbon steel or stainless steel tubing for high pressure construction. Both the JA and GA come standard pitched in the casing, for horizontal or vertical airflow.

Figure 1 - JA, GA Steam Distribution

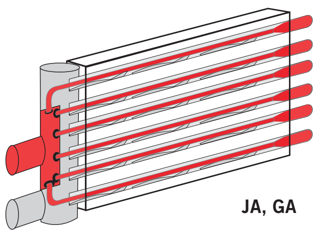
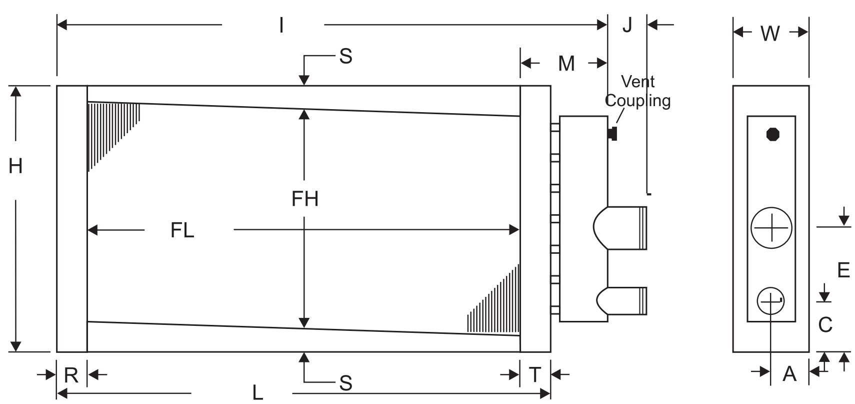


Figure 2 - JA, GA Dimension Info



*Recommend considering DA, LA construction if finned length is > 72"

Model Types - DA and LA (Figure 3) offer the same end return and supply connection with an additional supply connection at the opposite end. The steam is fed through both ends and the condensate is removed from one end. The DA coil is built with copper tubing for low pressure applications. The LA coils utilize cupro-nickel, admiralty brass, carbon steel or stainless steel tubing for high pressure construction. Both the DA and LA come standard pitched in the casing, for horizontal or vertical airflow.

Figure 3 - DA, LA Steam Distribution

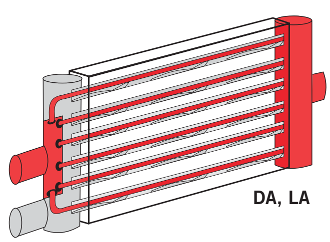
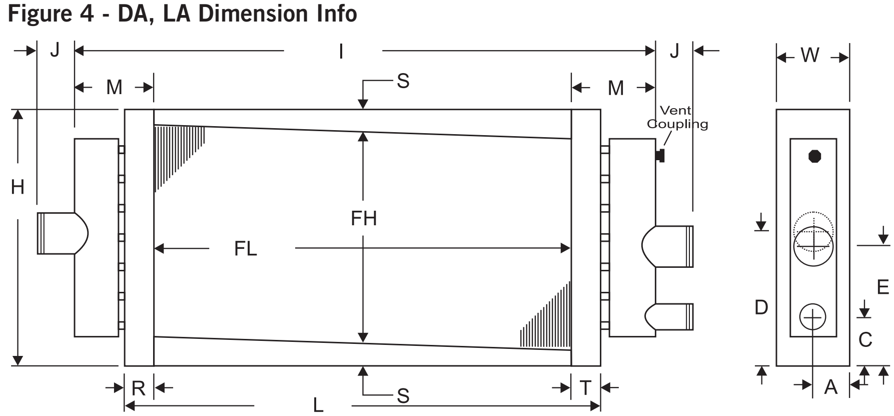


Figure 4 - DA, LA Dimension Info



Distributing Coil Types

Model Types - RA and TA (Figure 5) offer opposite end connections. Steam is fed from one end while condensate is removed from the opposite end. The RA coil is built with copper tubing for low pressure applications. The TA coils utilize cupro-nickel, admiralty brass, carbon steel or stainless steel tubing for high pressure construction. Both the RA and TA come standard pitched in the casing, for horizontal or vertical airflow.

Figure 5 - RA, TA Steam Distribution

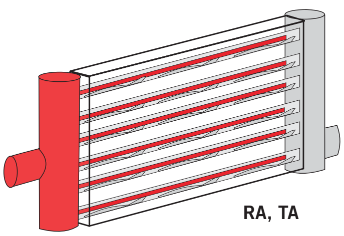
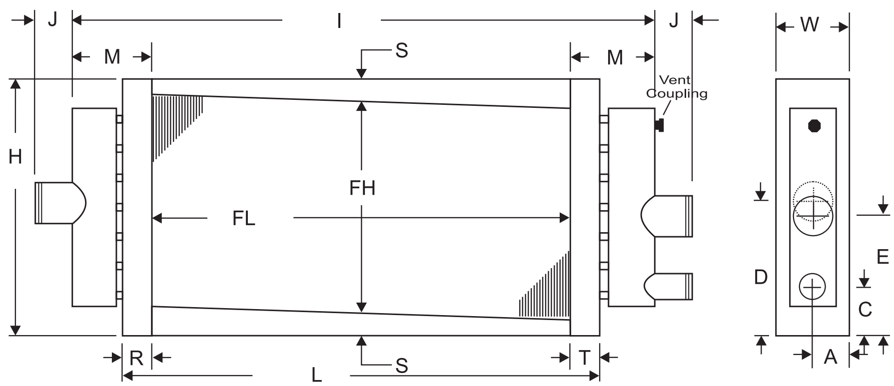


Figure 6 - RA, TA Dimension Info



Non-Distributing Coil Types

Non-distributing steam coils are specifically designed for economical general purpose heating. Featuring high quality and high capacity, they are an ideal choice for all regular steam applications - heating, reheating, booster, and process use. The sectional diagrams illustrate the steam circuiting of this single tube design. A perforated plate type steam baffle directly behind the supply connection assures even steam pressure across the entire header length. Inlet tube orifices meter a uniform flow of steam into each tube. This coil type is not recommended for entering air temperatures below freezing.

Model Types SA, HA, SB, and HB (Figure 7) are designed for general purpose heating. The construction features a single tube design with opposite end supply and return connections. A perforated baffle located directly behind the supply connection insures proper steam distribution. Models SA and SB (SB built on 3" centers) are constructed of copper tubing for low pressure construction. Model HA and HB (HB built on 3" centers) utilize cupro-nickel, admiralty brass, carbon steel or stainless steel tubing for high pressure construction.

Figure 7 - SA, HA, SB, HB Steam Distribution

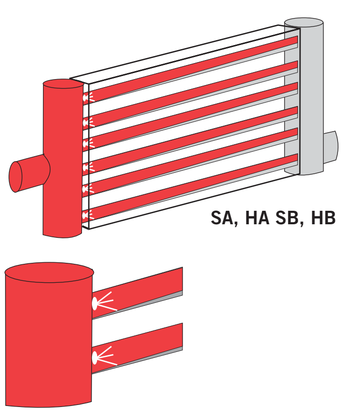
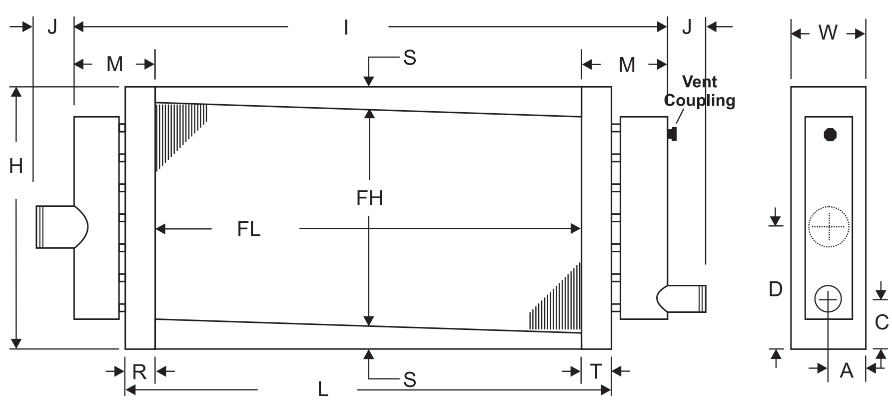


Figure 8 - SA, HA, SB, HB Dimension Info



Non-Distributing Coil Types

Model Types SS and SH (Figure 9) utilizes return bend construction and are not pitched in the casing. These coils must be installed level. Model Type SS and SH features return bend construction and same end connections. Model SS is constructed of copper tubing for low pressure construction. Model Type SH utilizes cupro-nickel, admiralty brass, carbon steel, and stainless steel tubing for high pressure construction.

Figure 9 - SS, SH Steam Distribution

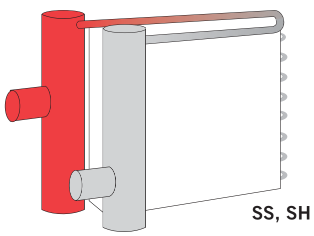
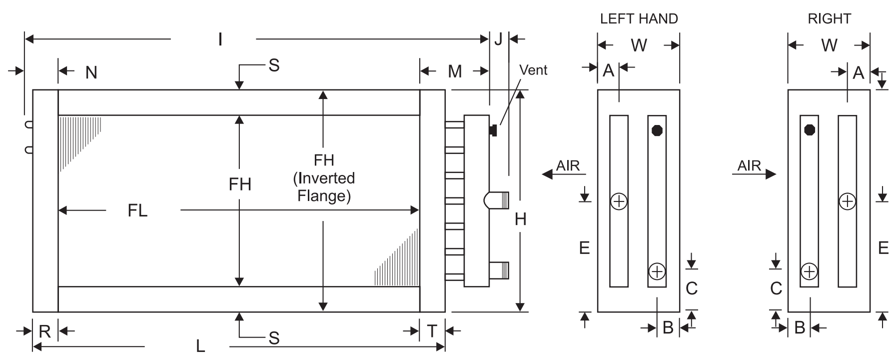


Figure 10 - SS, SH Dimension Info



Note: This design is not recommended for new installations, direct replacement only.

Steam Construction

CONNECTIONS

Connections are constructed of carbon steel, red brass or stainless steel material (see Table 1). All connections will be male pipe thread (MPT), unless specified differently. It is common practice, but not a necessary construction feature, for return connection sizes to be smaller than supply connection sizes. In order to aid in condensate removal and help avoid flooding the coil, the return connection should be the same size as the supply connection. In general, if the return connection is reduced, it should not be reduced more than one pipe size below the supply connection. Coil connections are centered on the coil depth for even steam distribution on opposite end standard steam coils. Same end standard steam coils have connections an equal distance from the entering and leaving air edge of the coil. Dimensions are based on connection sizes and casing style. Standard steam and steam distributing coils supply connections can be located vertically for ease of installation. Return connections for both coil types must be located low enough to assure proper drainage and are thus limited in location.

Table 1 - Material Options

Material
Copper Sweat UNS # 12200, ASTM B-75, with a H55 Temper
Stainless Steel 304L or 316L ASTM A 312 Sch 40 or Sch 80
Carbon Steel A53A Sch 40
Cupro-nickel UNS# C70600, 90/10, ASTM B-111
Admiralty Brass UNS # C444000, ASTM B-111, Type B

Steam Construction

Table 2 - Connection Sizes

<table>
<tr><th>Tube OD (in.)</th><th>Model</th><th>Rows</th><th>> FH (in.)</th><th>< FH (in.)</th><th>Conn. Size (in.)</th></tr>
<tr><td rowspan="9">0.625</td><td>DA, GA, JA, LA</td><td>1, 2</td><td rowspan="4">6.0</td><td rowspan="2">10.5</td><td rowspan="4">1.50</td></tr>
<tr><td>HA, HB, RA, SA, SB, TA</td><td>2</td></tr>
<tr><td>HA, HB, RA, SA, SB, SS, SH, TA</td><td>1</td><td rowspan="2">18.0</td></tr>
<tr><td>SS, SH</td><td>2</td></tr>
<tr><td>DA, GA, JA, LA</td><td>1</td><td rowspan="2">12.0</td><td rowspan="2">60.1</td><td>2.00</td></tr>
<tr><td>DA, GA, HA, HB, JA, LA, RA, SA, SB, TA</td><td>2</td><td>2.50</td></tr>
<tr><td>HA, HB, RA, SA, SS, SH, TA</td><td>1</td><td rowspan="2">18.0</td><td rowspan="2">60.1</td><td>2.00</td></tr>
<tr><td>SS, SH</td><td>2</td><td>2.50</td></tr>
<tr><td>All Models</td><td>1, 2</td><td>61.5</td><td></td><td>2.50</td></tr>
<tr><td rowspan="2">1.000</td><td rowspan="2">DA, GA, JA, LA, RA, TA</td><td rowspan="2">1</td><td>6.0</td><td>12.0</td><td>1.50</td></tr>
<tr><td>12.0</td><td>60.1</td><td>2.50</td></tr>
</table>

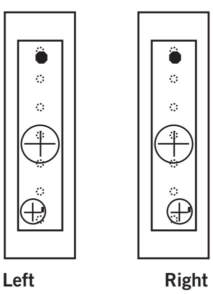
Offset Return Connections

This option is used when the steam coil is to be installed with vertical air flow. The return connection is lowered on the horizontally installed header to help coil drainage and avoid a trough of condensate remaining in the header. Orientation of the supply and return connection is required to offset return in the correct direction.

Offset Tubes

This is another method to help condensate removal in vertical air flow installations. The tubes are offset in the casing, providing the needed slope to drain condensate. The orientation of supply and return connections is required to offset tubes in the correct direction.

Figure 11 - Offset Return



HEADERS

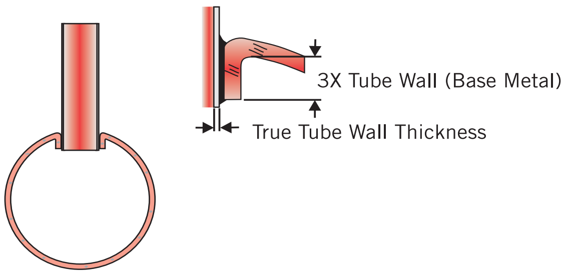
Headers shall be constructed from UNS C12200 seamless copper conforming to ASTM B-75 and ASTM B-251 for standard pressure applications. High pressure construction incorporates seamless 90/10 Cupro-nickel Alloy C70600 per ASTM B-251 and B-111. Stainless steel will be constructed of 304L & 316L (ASTM A-312) Sch-5 or Sch-10. Carbon steel shall be constructed of Sch-10 or Sch-40 per (ASTM A-53/A, A-106 or A-135). Steam coils will be equipped with factory-installed 0.50 inch FPT coupling to facilitate air vent connection placed at the highest point available on face of the return header. Tube-to-header holes are to be intruded inward such that the landed surface area is three times the core tube thickness to provide enhanced header to tube joint integrity. All core tubes shall evenly extend within the inside diameter of the header no more than 0.12 inch. End caps shall be die-formed and installed on the inside diameter of the header such that the landed surface area is three times the header wall thickness.

Steam Construction

BRAZED COPPER TUBES-TO-COPPER HEADER JOINT

Seamless copper tubes are brazed into heavy gauge seamless drawn copper headers. This combination of similar metals eliminates unequal thermal expansion and greatly reduces stress in the tube-header joint. Intruded tube holes in the header allow an extra large mating surface for increased strength and durability. (See Figure 12)

Figure 12 - Cu Tubes to Cu Header Joint



Steam Baffles (see page 3 SA, HA, SB and HB)

Supply header baffle disperses entering steam. Prevents blow-through or short circuiting and ensures steam distribution to all coil tubes.

COIL CASE

Casings and end plates shall be made from 16 gauge galvanized steel unless otherwise noted. Double-flanged casings on top and bottom of finned height are to be provided, when possible, to allow slacking of the coils. All sheet metal brakes shall be bent to 90 degrees +/- 2 degrees unless specified otherwise. Coils shall be constructed with intermediate tube support sheets fabricated from a heavy gauge sheets stock of the same material as the case, when possible. All steam coils are built with tube ferrules at every intermediate tube support and on both header plates. Unless otherwise requested, all steam coils manufactured by Luvata shall be case-pitched 0.125" per foot of in length. The bottom flange height will be adjusted to accommodate the slope. It is recommended the coils exceeding 72" finned length have dual supply.

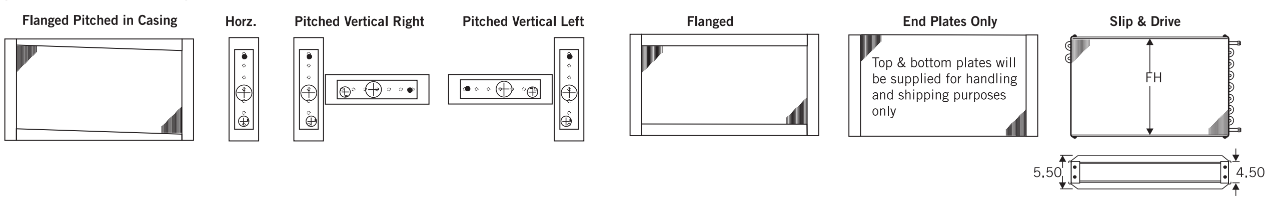
Free Floating Core

Steam casings are designed to let the core float free to provide for thermal expansion without creating stress and wear on the tubes. Since the core is not supported by the tubes there is no resultant tube wear.

Pitched Casings

Pitched casings are specially designed to provide the proper pitch for postivie condensate removal. Factory supplied pitched casings can save the extra installation time and expense required to provide for proper condensate removal on the job. Supply and return connections are properly sized for each coil to assure adequate steam distribution and proper condensate removal. See Figure 13 for optional case styles.

Figure 13 - Case Styles



Steam Construction

Table 3 - Case Material

Material	Gauge		
	16	14	12
Galvanized Steel, ASTM A-924 and A-653	X	X	*X
Copper ASTM B-152	X	X	X
Aluminum Alloy-3003, Embossed Finish Alloy-5052, Mill Finish (0.125 only)	X	X	X
Stainless Steel 304L (or) 316L, 2B-Finish, ASTM A-240	X	*X	*X

*Top and Bottom Plates Only

Tube Supports

Tube supports will be constructed of the same material as the case, when possible and provided according to the following chart.

Table 4 - Tube Supports

Finned Length (FL)	<48	> 48 ≤ 96	> 96 ≤ 144	> 144
Tube Supports	0	1	2	4

TUBING

Tubing and return bends shall be constructed from seamless copper for standard pressure applications. High pressure construction consists of cupro-nickel, admiralty brass, stainless steel or carbon steel tubing. Copper tube temper shall be lightly annealed with a maximum grain size of 0.040 mm and a maximum hardness of Rockwell 65 on the 15T scale. Tubes will be mechanically expanded to form an interference fit with the fin collars. Tubes shall have a nominal thickness of 0.020 inch unless otherwise specified. See Table 5 for size and material availability. See Tables 5 and 6 for more information.

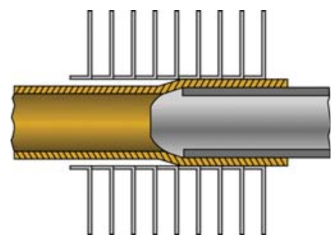


Table 5 - Material

Material
Copper UNS #C12200, ASTM B-75, B-68, B-251
Cupro-nickle UNS #C70600, 90/10, ASTM B-111
Admiralty Brass UNS #44400, ASTM B-111, Type-B
Stainless Steel 304L (or) 316L, ASTM A-249
Carbon Steel W&D ASTM 214

Table 6 - Tubing Information

Tubing Type	Connections	Tube O.D.	Tube Thickness
Copper	Carbon Steel, Red Brass	1.000	0.023, 0.035, 0.049
Cupronickel	Carbon Steel, Red Brass	1.000	0.035, 0.049
Red Brass	Red Brass	0.625	0.049
Stainless Steel	Stainless Steel	1.000	0.035, 0.049
Carbon Steel	Carbon Steel	1.000	0.035, 0.049

Steam Construction

FINS

Coils shall be built of plate fin type construction providing uniform support for all coil tubes. Coils are manufactured with die-formed aluminum, copper, cupro-nickel, stainless steel or cabon steel fins with self-spacing collars which completely cover the entire tube surface, providing metal-to-metal contact. The fin thickness will be 0.0075 +/- 5% unless otherwise specified. Fins are fabricated to accommodate 0.625 inch tubes 1.50 inch equilaterally spaced, for one row coils and 1.50 x 1.299, for two row coils. 1.0 inch diameter tube coils have tube holes with 3.0 inch tube face spacing. Fins are self-space die-formed fins 4 through 14 fins/inch with a tolerance of +/- 4%.

Table 7 - Fin Material

Material	Fin Thickness (in.)			
	0.0060	0.0075	0.0095	0.0160
Aluminum Alloy-1100	X	X	X	X
Copper Alloy-110	X	X	X	X
Cupro-nickel 90/10 Alloy-706		X		
Stainless Steel 302-2B		X	X	
Carbon Steel ASTM A109-83		X	X	

Table 8 - Fin Size

Tube OD (in.)	Fin Pattern (in.)	Fin Mtl	FPI (in.)	Fin Style	Fin Thickness (in.)			
					0.0060	0.0075	0.0095	0.0160
0.625	1.50 x 1.299	AL, CU	4-7	A, B			X	X
				C			X	
			8-14	A, B	X	X	X	X
				C	X	X	X	
	1.50 x 1.50	SS, CS	4-5	F, G, H			X	
			6-14			X	X	
1.000	3.00 x 2.125	AL, CU	4-14	B			X	
		SS, CS	4-5				X	
			6-14			X	X	

Engineering

CORE TUBE CONSIDERATIONS

Table 9 is to be used as a guideline only. If within 10 psi of next wall thickness, consider the next heavier tube wall to extend coil life. Below recommendations are based on field experience.

Table 9 - Core Tube Considerations

Steam (psig)	Tube Thick. (in.) & Matl
> 2 & < 20	0.020 Copper
> 20 & < 50	0.025 Copper
> 50 & < 75	0.035 Copper
> 75 & < 100	0.049 Copper
> 100 & < 150*	0.020 Cupronickel
> 150 & < 200*	0.035 Cupronickel
> 200 & < **	0.049 Cupronickel

* 0.049 Admiralty brass is an option for the pressures noted
** Consult factory for applications over 200 psig

Engineering

MAXIMUM OPERATING TEMPERATURE FOR TUBE MATERIAL

Based on average temperature across coil (entering air + leaving air ÷ 2)

Table 10 - Tube Temperature

Tube Material	Max Temp. (°F)
CU (Copper)	350
CuNi (Cupronickel)	450
Admiralty Brass	450

Note: All considerations are based on typical systems and conditions of service. A specialty steam consultant or distributor should be contacted for specific recommendations on a particular application.

GENERAL FORMULAS

BTUH

BTUH = 1.08 x SCFM x Temp. Rise
Where 1.08 = (Specific heat of air) x Min./Hr.) x Density Std. Air

Specific heat = 0.24 at 70°F
Min./hr. = 60
Density Std. Air = 0.075 Lbs./cu. ft.

TEMPERATURE RISE (TR)

TR = BTUH ÷ (1.08 x SCFM)

LEAVING AIR TEMPERATURE

Lvg Air Temp. = Ent. Air Temp. + Temp. Rise

FACE AREA

FA = (Fin Height x Finned Length) ÷ 144

FACE VELOCITY (FPM)

FPM = SCFM ÷ Face Area (sq. ft.)

POUNDS CONDENSATE

Lbs Cond./HR. = BTUH ÷ Latent Heat of Steam

PROPERTIES OF SATURATED STEAM

Table 11 - Steam Properties

Pressure (psig)	Temp (°F)	Latent Heat (btu/lb)
2	218.64	966.20
5	227.33	960.40
10	239.59	952.50
15	249.83	945.60
20	258.91	939.40
25	266.92	933.90
30	274.11	928.80
40	286.84	919.60
50	297.73	911.70

Pressure (psig)	Temp (°F)	Latent Heat (btu/lb)
60	307.48	904.40
70	316.01	897.90
80	324.08	891.60
90	331.29	886.00
100	337.95	880.50
125	352.89	868.20
150	365.92	856.90
175	377.43	846.80
200	387.93	837.20

THERMOSTATIC AIR VENT AND VACUUM BREAKER

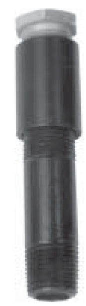
Thermostatic Air Vent

The thermostatic air vent allows the system to purge itself of non-condensables. As non-condensables gather at the high point in the system, the vent's thermostatic mechanism becomes "insulated" by the non-condensables and begins to cool and relaxes to its open position. The vent opens allowing the gases to escape and be replaced by the higher temperature steam. The vent closes as steam replaces the escaped gases and begins the process of heating or expanding the mechanism back to it's closed position. The vent remains closed until the lower temperature non-condensables again replace the higher temperature steam.

Thermostatic air vents are available for coils for steam pressure up to 125 psig. For coils with operating pressure above 125 psig and ≤ 300 psig the factory should be consulted for lead-time.

Vacuum Breaker

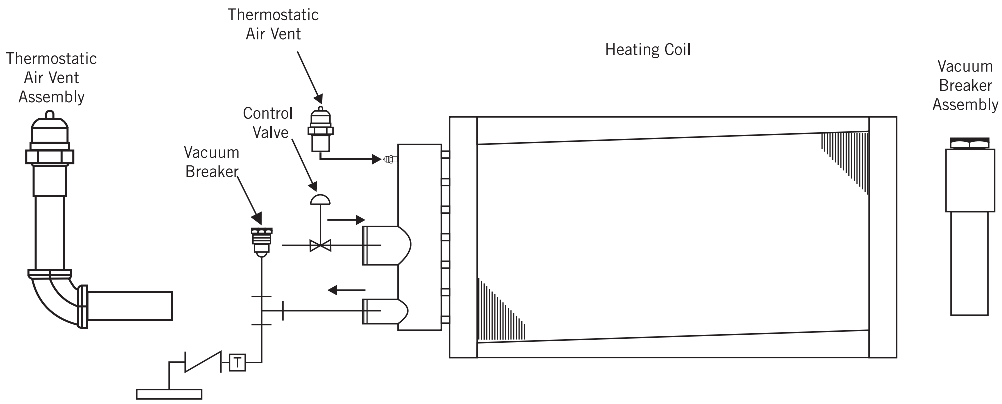
The vacuum breaker allows the coil to purge itself of an internal vacuum, typically caused by a modulating control valve. When the control valve throttles back, the steam pressure due to reduced load demand, it inherently creates a vacuum in the coil as the existing steam inside the coil begins to condense. If left to it's own design, condensing steam, which is allowed to pull a vacuum, can cause catastrophic damage to any coil or pressurized vessel. The presence of vacuum conditions activates the vacuum breaker and allows air to enter the coil thus breaking the vacuum, and allowing condensate to flow freely from the coil.



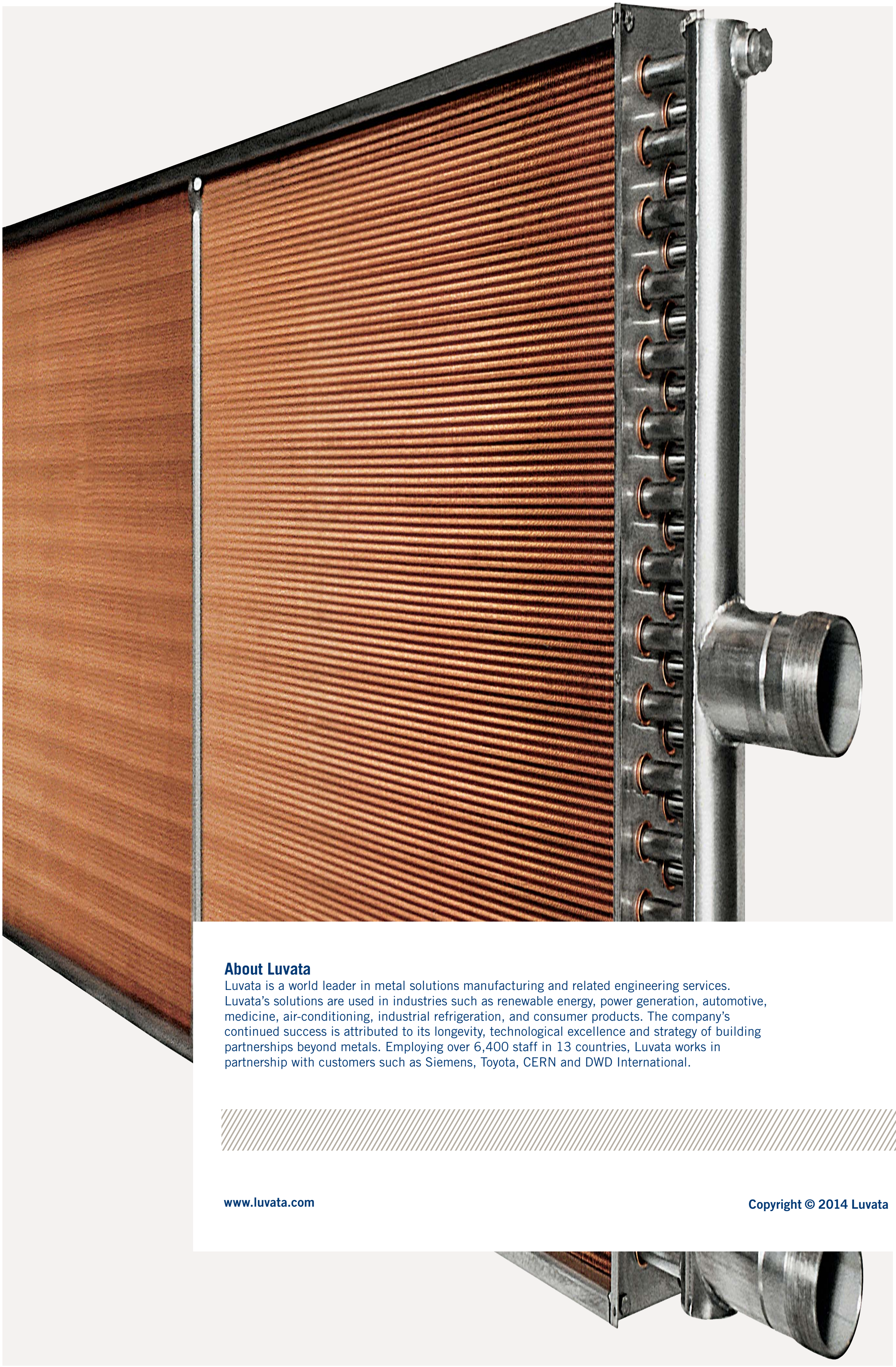
***Both assemblies supplied with piping components shown**

ASSEMBLY

Figure 14 - Vacuum Breaker Assembly



For more information, please contact:
Luvata Grenada LLC
Grenada, MS, USA
Phone +662 229 4000
Fax +662 229 4212



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