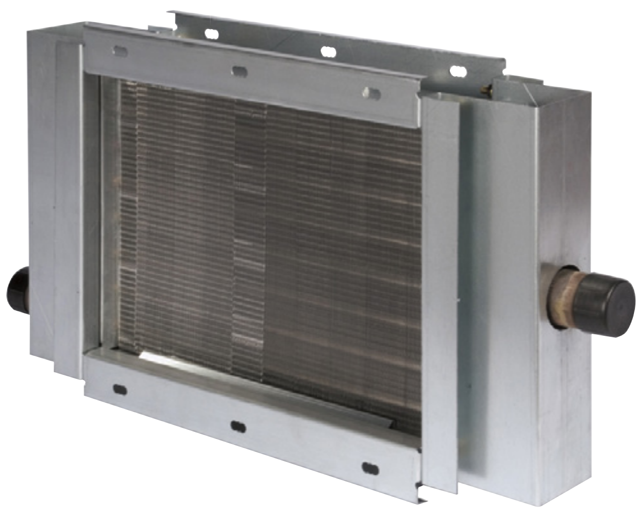
Catalog 413-6

Steam Coils

Types HI-F5, HI-F8 and E-F5



HI-F5, HI-F8 and E-F5 Steam Coils

Daikin Tools™ for Contractor Coils

Daikin Applied offers an unmatched variety of standard fin spacings,row and circuiting combinations. For optimum coil selection, Daikin Tools for Contractor Coils selection program makes it easy to select the most economical standard or special application coil to meet your job requirements. Contact your local Daikin Applied representative for a coil selection that meets the most exacting specification.

AHRI Certification

Daikin steam coils are certified in accordance with the forced circulation air cooling and air heating coil certification program, which is based on AHRI Standard 410. To obtain AHRI certification ratings, it is first necessary to have the testing facilities reviewed for proper instrumentation, control and accuracy of test data. A coil is then submitted to an AHRI approved independent testing facility for comparative tests. AHRI then approves the coil manufacturer's testing facilities. After the testing facilities are approved, the coil is tested over a wide range of operating conditions. All rating data is the reviewed by AHRI engineers for accuracy and confirmation that procedures established by AHRI have been followed. Periodic check lists of production coils by AHRI, on a random basis, assures compliance with AHRI standards.

NOTE: Special application coils may be outside the scope of AHRI Standard 410.

Nomenclature

5 SA – 12 02 C – 033.00 – 090.00

Tube O.D. (5)
5 = 5/8 inch
8 = 1.0 inch

Coil Type (SA)
5SA = Single tube, opposite end connection
5JA, 8JA = Distribution tube, same end connection
5HA = High pressure construction, single tube, opposite end connection
5GA, 8GA = High pressure connection, distribution tube, opposite end connection
8TA = High pressure connection, distribution tube, opposite end connection

Fins per Inch (12)
HI-F5, E-F5 (06, 07, 08, 09, 10, 11, 12, 13, 14)
HI-F8 (03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14)

Rows Deep (02)
HI-F5, E-F5 (01, 02)
HI-F8 (01)

Fin Design (C)
B = 01 and 02 Row E-F5
C = 01 and 02 Row HI-F5
B = 01 Row HI-F8 (1")
A = Flat

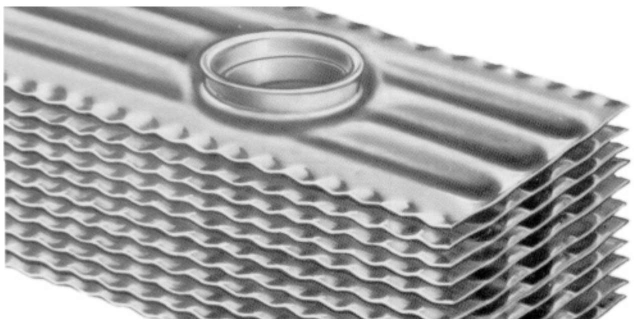
Fin Height (inches) (033.00)

Finned Length (inches) (090.00)

A Pioneer In Corrugated Fin Development

HI-F Means High Efficiency

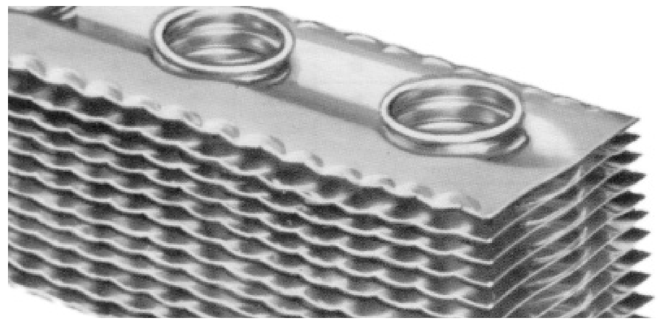
A principal factor governing fin heat transfer efficiency is the boundary layer film of air adhering to any fin surface. This boundary layer insulates the fin, severely reducing the rate of heat exchange. The advanced rippled-corrugated HI-F design creates a state of continuous turbulence which effectively reduces the boundary layer formation. The exclusive rippled edge instantly deflects the incoming air to create initial turbulence. A succession of corrugations across the fin depth, in conjunction with the staggered tubes, increases the turbulating effect and eliminates the “dead spots” behind the tubes. In this manner, the HI-F design establishes a new high in heat transfer efficiency yielding sharply increased performance. The rippled fin edge also strengthens the fin edge and provides a pleasing overall appearance.



E-F Means Energy Efficient

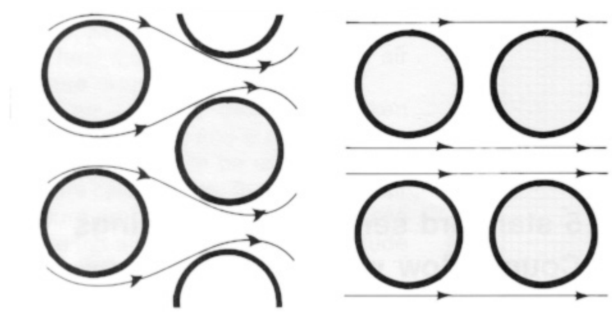
The term “energy efficient,” which is used to describe how well a system utilizes energy, has become a common expression in the HVAC industry.

With costs of energy rising, the need for cutting operating expenses is apparent. Lowering the air pressure drop across the face of the coil will reduce the fan brake horsepower requirement and fan motor electrical demand. The need to cut operating energy expenses is met by the E-F fin surface. The smoother fin design of the E-F surface results in lower operating costs over the life of the equipment.



Staggered Tube Design For High Performance

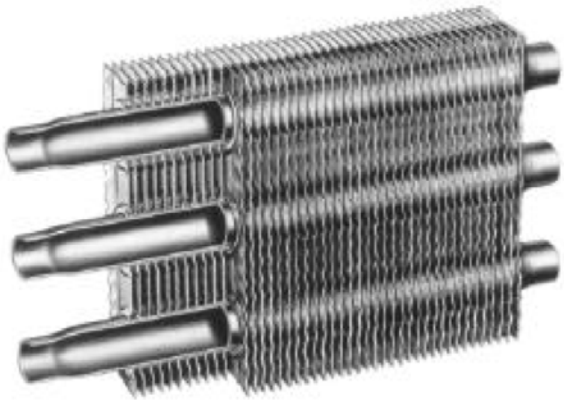
The more moving air in contact with the tubes in the coil, the more performance obtained from the total available surface. The staggered tube design exposes the tubes to more moving air than the in-line design. The geometry of the staggered tube design also allows the rows to be spaced closer together. This results in a more compact coil providing higher capacities.



Design Features

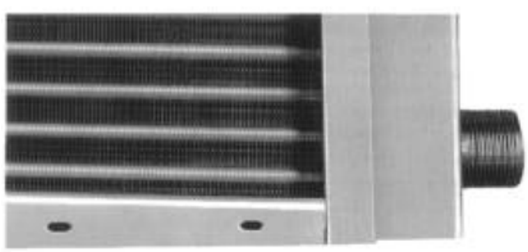
Patented Fin Designs

The HI-F and E-F fin surfaces give the flexibility needed to perform at optimum efficiency. Seamless drawn copper tubes are mechanically expanded into full drawn, die-formed fin collars to provide positive metal-to-metal contact for high heat transfer efficiency and long coil life.



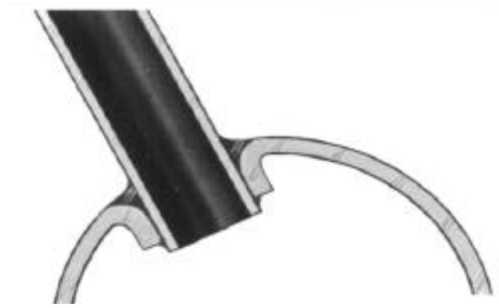
Pitched in the Casing

The specially designed casing automatically provides the proper pitch for positive condensate removal resulting in reduced installation and expense. Supply and return connections are properly sized for each coil to assure optimal distribution and proper condensate removal.



Brazed Copper Tubes-to-Copper Header Joint

Seamless copper tubes 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 area for increased strength and flexibility designed to provide many years of trouble-free service.



Free Floating Core

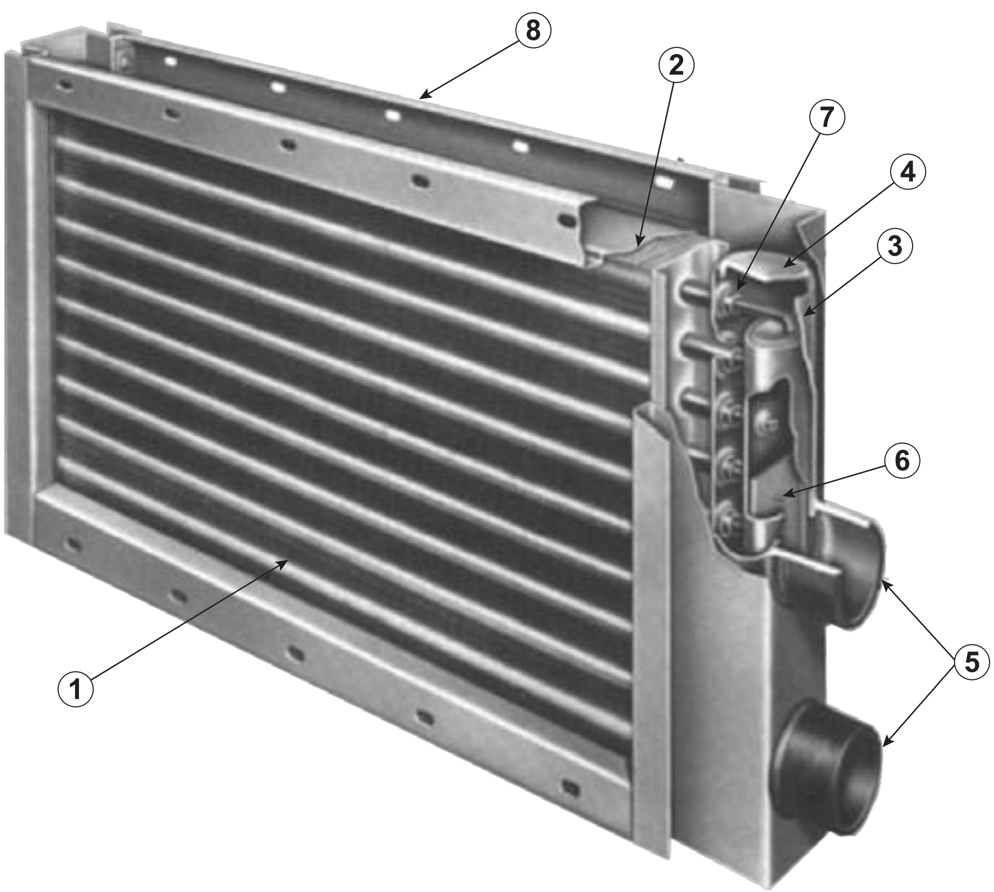
One of the most important requirements of a steam coil design is to allow for thermal expansion without creating stress and wear on the tubes.

To provide for this requirement, the coil core must be free to expand and contract within the casing without inducing wear on the tubes. A special coil casing has been designed in which the coil core is free to float in a recessed fin channel. Since the core is not supported by the tubes there is no resultant tube wear. The recessed fin channel prevents air bypass while adding structural support to the casing.

General Specifications

1. **Primary Surface** — 5/8" O.D. and 1" O.D. round seamless copper tubes. Cupro-nickel tubes are used for high pressure construction. Tubes are mechanically expanded to provide a continuous compression bond to the fins.
2. **Secondary Surface** — HI-F5, E-F5 and HI-F8 rippled-corrugated aluminum die-formed plate type fins. Fin collars are full drawn to provide accurate control of fin spacing and maximum contact with tubes.
3. **Headers** — Extra-heavy seamless copper tubing with intruded tube holes. Provides flexibility for uneven stress during coil expansion and contraction. Cupro-nickel used for high pressure construction.
4. **Header End Caps** — Heavy-gauge, die-formed copper. Monel used for high pressure construction.
5. **Connections** — Steel male pipe supply and return connections properly sized for coil capacity. Other materials available on request. (Red brass connections recommended for coils used with non-ferrous piping.)
6. **Steam Baffles** — Supply header baffle disperses entering steam. Prevents blow-through or short circuiting and ensures equal steam distribution to all coil tubes.
7. **Brazing** — All core joints are brazed with copper brazing alloys. Headers have intruded tube holes which provide maximum brazing surface and ensure lasting strength.
8. **Casings** — Die-formed heavy-gauge continuous galvanized steel with reinforced flanges and 3/8" × 3/4" slots on 6" centers for easy mounting. Fin channels brace the core assembly in the casing, preventing air bypass and damage in handling.
9. **Pitched in Casing** — Coil cores are pitched in the casing toward the return connection for horizontal airflow. Provides proper condensate drainage and ease of installation.
10. **Free Floating Core** — Design permits coil core to “float” free in the coil casing during expansion and contraction.
11. **Tests** — Complete coil tested leak free at 315 psig air pressure under warm water containing special wetting agent.
12. **Operating Conditions** — Standard coils rated up to 150 psig and up to 366°F temperatures. High pressure coils up to 350 psig and 450°F.When steam pressure is above 25 psig, high pressure coils are recommended for longer coil life.

Figure 1: Steam Coil Components



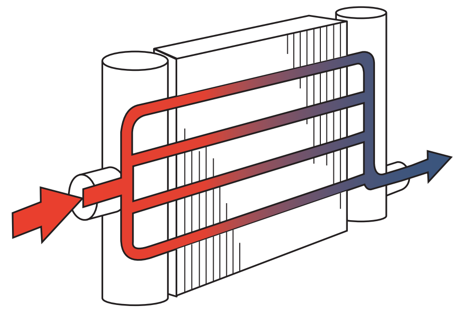
Steam Circuiting Arrangements

Select HI-F5, E-F5 and HI-F8 steam coils from three different circuiting arrangements: the general purpose 5SA coil, and two jet tube steam distributing styles-5JA, 8JA and 8RA coils-intended for both general and special purpose heating. While each of these arrangements has been carefully designed to serve a particular area in steam coil application, sufficient similarities are present in design and performance to render them interchangeable in many cases. Optimal fin design provides a high performing heat transfer surface while a host of exclusive features provide extended coil life.

5SA & 5HA General Purpose Steam Coils

5SA and high pressure 5HA 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.

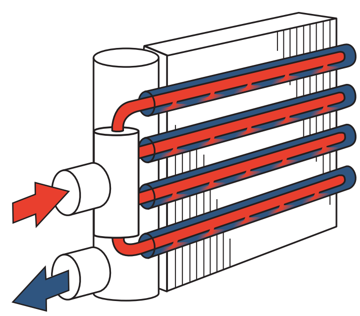
The sectional diagram illustrates the steam circuiting of this single tube design. A perforated plate type steam baffle directly behind the supply connection ensures even steam pressure across the entire header length. Inlet tube orifices meter a uniform flow of steam into each tube.



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

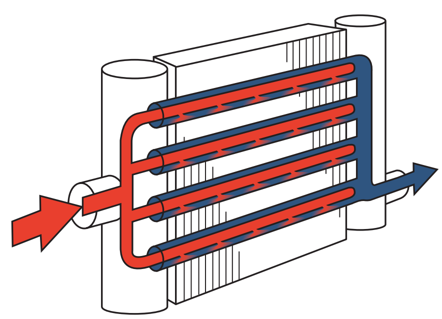
5JA, 8JA and high pressure 5GA and 8GA jet tube steam distributing coils are excellent for any general purpose heating application. With the superior freeze resistance provided by the tube-within-a-tube construction, they are ideal for low temperature preheating and special process applications.

The construction, as illustrated, features directional orificed inner tubes, a unique elliptical supply header located inside the heavy-duty return header and a circuiting arrangement which provides both supply and return connections at the same end of the coil.



8RA & 8TA Opposite End Connection Jet Tube Distributing Coils

8RA and high pressure 8TA jet tube steam distributing coils are very similar in design and operation to the “JA” coils except that supply and return connections are located on opposite ends.



Directional Orifices

The directional orifices properly meter steam along the entire tube length to assure a consistent temperature rise across the full coil face and accelerate condensate removal. This important feature is standard on all of our jet tube steam distributing coils.

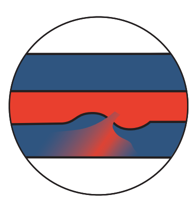


Table 1: Standard Availability Chart

Coil type			Steam (single tube)		Steam (distributing tube)					
Coil model			**5SA**	**5HA**	**5JA**	**5GA**	**8JA**	**8GA**	**8RA**	**8TA**
Serpentine circuit			Does not apply		Does not apply					
Rows			1,2		1,2		1			
Connection location			Opposite end		Same end		Same end		Opposite end	
Fin height, 3" increment			12" to 42"							
Fin length, 0.10" increment			12" to 129"							
Fin spacing (FPI)			6 to 14				3 to 14			
Fins	Fin type	HI-F	●	●	●	●	●	●	●	●
		E-F	●	●	●	●				
		Flat	●	●	●	●				
	Aluminum	0.0075	●	●	●	●				
		0.0095	●	●	●	●	●*	●*	●*	●*
		0.0120					●		●	
	Copper	0.006	●	●	●	●				
		0.0075	●	●	●	●	●*	●*	●*	●*
		0.0095	●	●	●	●	●*	●*	●*	●*
Tubing	Copper	0.020[1]	●		●					
		0.025	●		●		●		●	
		0.035	●		●					
		0.049	●		●		●		●	
	Cupro-nickel	0.020		●		●				
		0.035		●		●		●		●
		0.049		●		●		●		●
Tubing diameter			5/8"		5/8"		1"			
Tubing face C/C			1.5		1.5		3.0			
Headers standard material			Copper	Cu Ni	Copper	Cu Ni	Copper	Cu Ni	Copper	Cu Ni
Maximum standard operating limits		P	150 psig	350 psig	150 psig	350 psig	150 psig	350 psig	150 psig	350 psig
		T	366°F	450°F	366°F	450°F	366°F	450°F	366°F	450°F

● Feature available.
* Requires 6 fins per inch or more.
1. 0.020 is a nominal tube thickness.

Flexibility

Along with the standard offerings, optional materials and special configurations are provided to meet many different specifications. Extra long finned lengths, intermediate tube supports, along with a wide variety of tube wall and fin thicknesses are available. Casings can be constructed of galvanized steel, aluminum, stainless steel or copper. Optional connection materials such as steel, red brass or copper (sweat) are offered along with butt-weld, victaulic or flange type connections. Coil coatings can be phenolic or Electro Fin. These are just a few of the options and specials that can be provided. Consult your local representative for your special coil requirements.

NOTE: Special application coils may be outside the scope of AHRI standard 410.

Coil Selection Considerations

Because we offer a wide variety of steam coil types, materials and fin spacings, you can obtain a very accurate selection. To obtain proper selection of each coil, the following variables should be considered.

Entering Air Temperature

Two basic types of steam coils are offered - the single tube steam coil and the jet distributing tube steam coil.

The single tube steam coil, type 5SA, is generally more economical when applied in an above freezing environment. When the entering air is near or below freezing, the jet distributing tube steam coils, types 5JA or 8JA, should be selected to provide maximum resistance to coil freeze-up.

Leaving Air Temperature

The selection of a coil to deliver a desired leaving air temperature is relatively simple, as it involves only dry bulb temperatures and sensible heating. Steam coils may be accurately selected to deliver the desired leaving air temperature by varying the fin series and number of rows deep. In the interest of coil economy, the higher fin series should be used in place of additional rows deep. However, in some instances, the system air pressure drop and/or condensate loading may dictate the use of a lower fin series and more rows deep.

NOTE: Oversized steam coils can present a control problem. Coils should be sized as accurately as possible.

Operating Steam Pressures

Standard steam coil construction is designed to withstand operating pressures up to 150 psig and give very satisfactory service. However, the primary factors in coil life are erosive and corrosive actions, both of which are greatly accelerated with increased steam pressures. Corrosive action may be partially controlled by using compounds that will maintain the proper pH in the system. However, the best protection to prolong coil life is to use heavy-duty high pressure steam coil construction. Although high pressure construction is not necessary up to 150 psig, it is highly recommended for longer coil life and coil economy when operating steam pressures exceed 25 psig.

Air Volume (CFM)

The CFM to be handled will be determined by the consideration of the installation. The coil size selected must be capable of handling the total CFM at face velocities (FPM) acceptable to the heating application. Face velocities may range from 200 to 1500 FPM with 600 to 700 FPM a common design range.

When the specified air volume is not at standard air conditions, 70°F and sea level, the CFM must be corrected, as Conversion of Air Volume to Standard Air on page 12, before using the curves and tables in this catalog.

Lowering Airside Pressure Drop

The E-F5 fin is designed to lower the air pressure drop from 20% to 30% for a given application. Although more surface may be necessary to maintain capacity, the cost can be amortized by the lower fan brake horsepower requirements. The payback may be realized in just a few months.

Freezing Conditions

When the entering air to the coil is below freezing, the use of coils in series airflow and the correct control system is the best protection against coil freeze-up. In such a system, the first coil in the direction of airflow would use a two-position control valve that would open to full steam pressure (5 psig minimum) whenever the outside air temperature drops below freezing and would be capable of raising the entering air from the minimum expected outside temperature to at least 35° F. The second coil would use a modulating control valve and would raise the entering air up to the final required leaving air temperature. By using this type of system, the first coil could not freeze, because it would always be in full operation when the entering air temperature is below 35°F. The second coil could not freeze because the entering air temperature would always be above 35°F.

For ease of control and maximum freeze protection, the use of an additional preheat coil is recommended when the entering air temperature is expected to drop well below freezing. In such a system, the first coil would be the smallest and would open at 35°F. The second coil would open at about 10°F to 15°F outside air temperature, depending on the capacity of the first coil. A third coil would be modulated to obtain the final leaving air temperature.

In calculating the air temperature rise through the second and third coil, the leaving air temperature off the first coil is used as the entering air temperature to the second coil, etc.

For additional recommendations regarding freezing conditions, refer to Freezing Conditions on page 22.

Individual Installation Requirements

Each installation will have its own particular requirements. Normally one of the wide variety of our steam coils will conveniently fill these requirements without modification.

If the application is to be zoned, the uniform air temperature distribution of types 5JA, 8JA and 8RA makes these coils well suited.

Where problems such as special controls, atmosphere contamination, special process applications, etc., indicate the need for a special coil, contact your local representative. This individual welcomes the opportunity to assist you.

Sample Coil Selection

BTUH required 1,830,000
CFM (standard air) 24,000
Coil face . . . . .36" × 120"
Saturated steam pressure . . . . 10 psig
Entering air temperature . . . . -10°F
Coil type . . . . .HI-F Single Tube Coil

Coil Face Area:

$$FA = \frac{36 \times 120}{144} = 30.0 \text{ sq. ft.}$$

Coil Face Velocity:

$$FV = \frac{CFM}{FA} = \frac{24{,}000}{30.0} = 800 \text{ FPM}$$

TR/ITD Method:

1. Determine TR/ITD:

   $$TR = Lvg.\ Air - Ent.Air = \frac{BTUH}{1.09 \times CFM}$$

   $$\frac{1{,}830{,}000}{1.09 \times 24{,}000} = 70°F$$

   ITD = Sat. Steam Temp. - Ent. Air Temp.

   Sat. Steam Temp. = 239.4 (Table 3 on page 19)

   $$TR/ITD = \frac{70}{239.4\ (-10)} = 0.281$$

2. Initial Selection

   Enter Figure 4 at 800 FPM to determine which coil meets or exceeds a TR/ITD of 0.281. A 5SA1001C coil has a TR/ITD of 0.292.

3. Determine Condensate Loading Factor (F_L)

   $$Condensate\ Loading = \frac{BTUH}{Latent\ Heat \times Tubes\ Fed}$$

   Latent Heat = 952.6 (Table 2, page 16)

   Tubes Fed = 24 (Table 3, page 16)

   $$\frac{1{,}830{,}000}{952.6 \times 24} = 80.0 \text{ Lb. / Hr. / tube}$$

   Enter Figure 7 at 80.0 lbs./hr./tube and 10 psig to find F_L = 0.995.

4. Final Selection

   Actual TR / ITD = 0.292 × 0.995 = 0.290 (greater than 0.281)

   Final Selection: 5SA1001C - 36 × 120

5. Air Pressure Drop

   Refer to Figure 10 and find air pressure drop of 0.37" $H_2 0$.

6. Determine Actual Condensate Loading

   Actual TR = 0.290 × [239.4 (-10)] = 72.3

   Actual BTUH = (1.09) (24,000) (72.3) = 1,892,000

   $$Actual\ Condensate\ Load = \frac{BTUH}{Latent\ Heat}$$

   $$\frac{1{,}892{,}000}{952.6} = 1986 \text{ Lb. / Hr.}$$

7. Determine Actual Leaving Air Temperature

   Actual Lvg. Air Temp. = Ent. Air Temp. + TR
   = (-10) + 72.3 = 62.3°F

Base Temperature Rise Method:

1. Determine Air Temperature Rise

   $$TR = \frac{BTUH}{1.09 \times CFM} = \frac{1{,}830{,}000}{1.09 \times 24{,}000} = 70°F$$

2. Determine Steam Conversion Factor (F_S)

   F_S = 1.098 (Table 2 on page 19)

3. Determine Condensate Loading Factor (F_L)

   $$\text{Condensate Loading} = \frac{BTUH}{\text{Latent Heat} \times \text{Tubes Fed}}$$

   Latent Heat = 952.6 (Table 3 on page 19)

   Assume 1-row coil. If 1-row coil does not meet required capacity, the following steps should be repeated for a 2-row coil:

   Tubes Fed = 24 (Table 4 on page 19)

   $$\frac{1{,}830{,}000}{952.6 \times 24} = 80.0 \text{ Lb. / Hr. / tube}$$

   F_L = 0.995 (Figure 7)

4. Determine Base Temperature Rise Required

   $$\text{Base Temp. Rise Required} = \frac{\text{Air Temp. Rise}}{FT \times FL}$$

   $$\frac{70}{1.098 \times 0.995} = 64.1°F$$

5. Coil Selection

   Enter Figure 4 at 800 FPM to determine which coil meets or exceeds a base temperature of 64.1°F. A 5SA1001C coil has a base temperature of 66.2°F.
   Final Selection: 5SA1001C - 36 × 120.

6. Air Pressure Drop

   Refer to Figure 10 and find air pressure drop of 0.37" H_2O.

7. Actual Condensate Loading

   Actual TR = Base × F_T × F_L

   66.2 × 1.098 × 0.995 = 72.3

   Actual BTUH (1.09) (24,000) (72.3) = 1,892,000

   $$\text{Actual Condensate Load} = \frac{BTUH}{\text{Latent Heat}}$$

   $$\frac{1{,}892{,}000}{952.6} = 1986 \text{ lb/hr.}$$

General Formulas

1. BTUH:

   BTUH = 1.09 × CFM × Temperature Rise

   Where:
   1.09 = 0.242 × 60 × 0.075
   0.242 = Sp. Ht. of Air at 70°F
   60 = Min. / Hr.
   0.075 = Density Std. Air in Lbs. / Cu.Ft.
   Temp. Rise = Lvg. Air Temp. - Ent. Air Temp.

2. Temperature Rise (TR):

   $$TR = \frac{BTUH}{1.09 \times CFM}$$

3. Leaving Air Temperature

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

4. Initial Temperature Difference (ITD):

   ITD = Ent. Water Temp. - Ent. Air Dry Bulb

5. Face Velocity (FPM):

   $$FPM = \frac{CFM}{\text{Face Area (Sq. Ft.)}}$$

6. Pounds Condensate:

   $$\text{Lbs. Cond. / Hr.} = \frac{BTUH}{\text{Latent Heat of Steam}}$$

7. Condensate Loading:

   $$\text{Lbs. Cond./Hr./Tube} = \frac{BTUH}{\text{Latent Heat of Steam} \times \text{No. Tubes Fed}}$$

Conversion of Air Volume to Standard Air

When the specified air volume (CFM) is given at any temperature other than sea level, these charts should be used for correction before using the capacity and pressure drop tables which are based 1.20 on CFM at standard air conditions.

Example:

To convert 15,900 CFM of air at 95°F and at 3,000 feet altitude to standard conditions:

CFM of Standard Air

= *(CFM of Specified Air × F_T × F_A)*

= *15,900 × 0.955 × 0.896*

= *13.600*

Where:

F_T = *Temperature Conversion Factor*

F_A = *Altitude Conversion Factor*

The CFM of standard air should be used to determine face velocity through the coil, which in turn is used to determine heat transfer values, and the air pressure drop through the coil.

The air pressure drop value taken from Figure 10, Figure 11, and Figure 12 must be converted to altitude to be used for static pressure calculations. To convert the air pressure drop from standard air at sea level to the air pressure drop at altitude use the following equation:

$$\text{Pressure Drop at Altitude} = \frac{\text{Pressure Drop at Sea Level}}{F_T \times F_A}$$

Figure 2: Temperature Conversion Factor

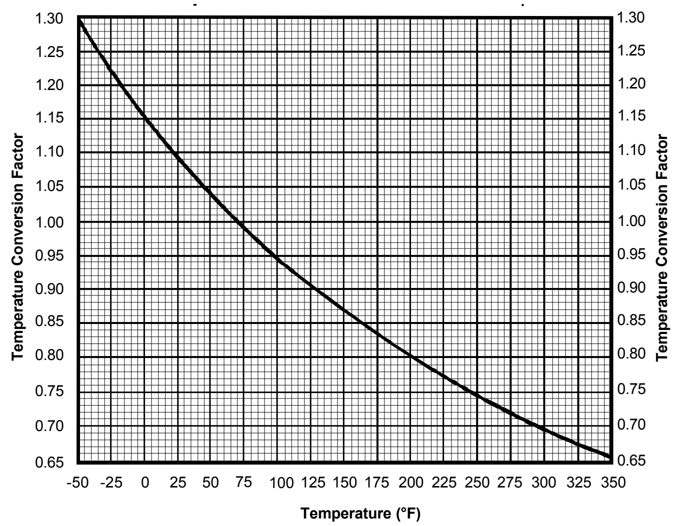


Figure 3: Altitude Conversion Factor

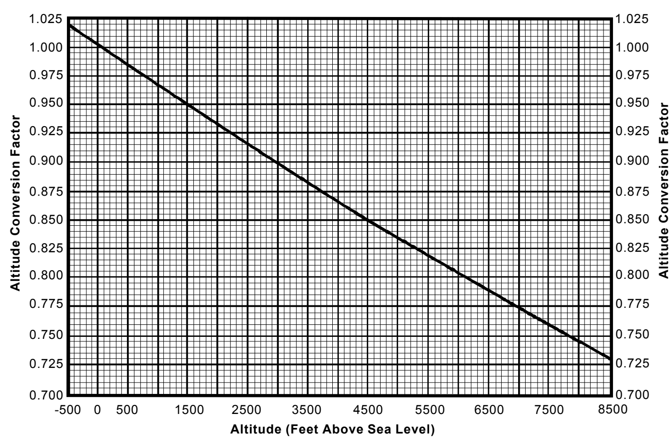
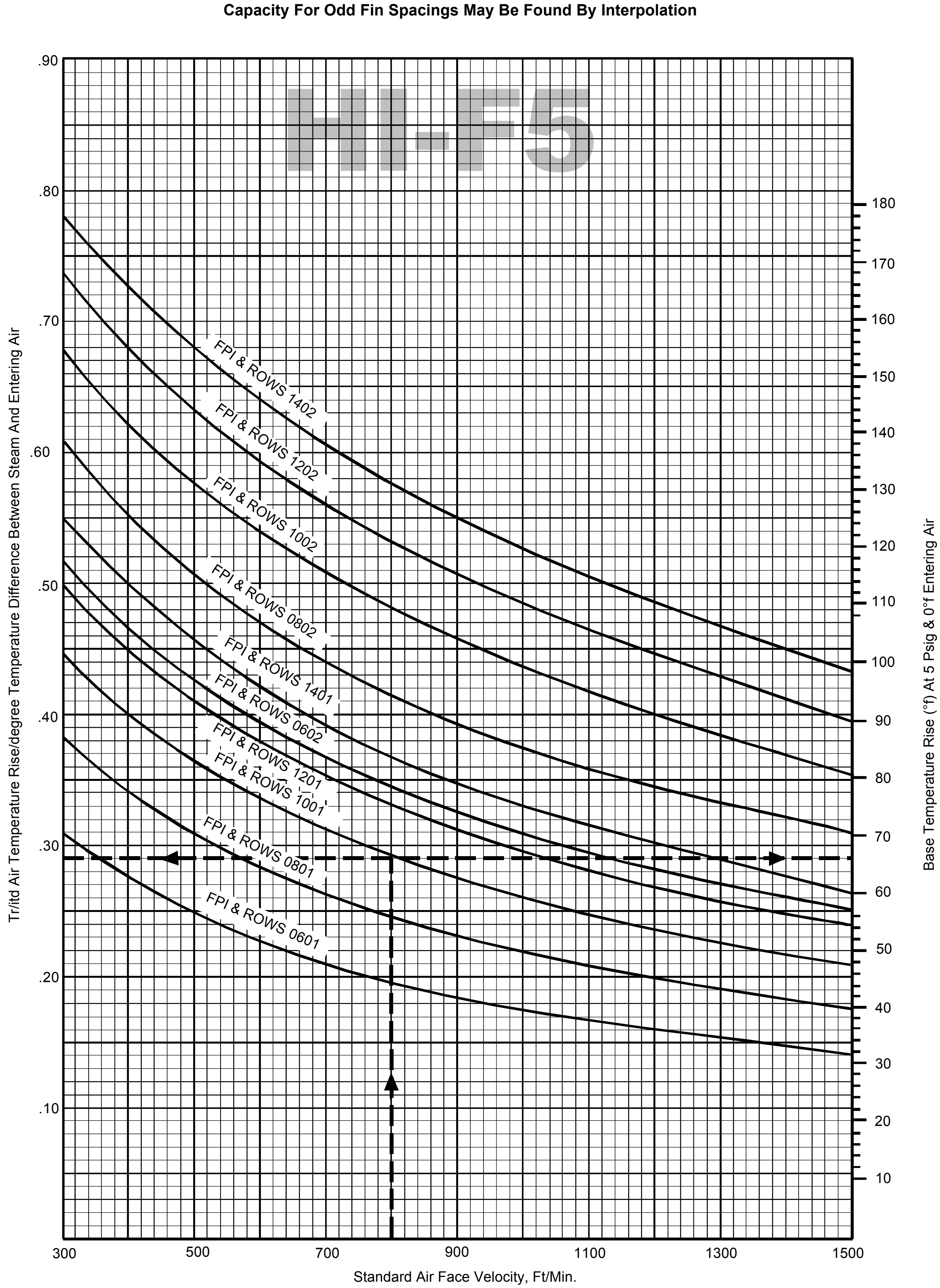


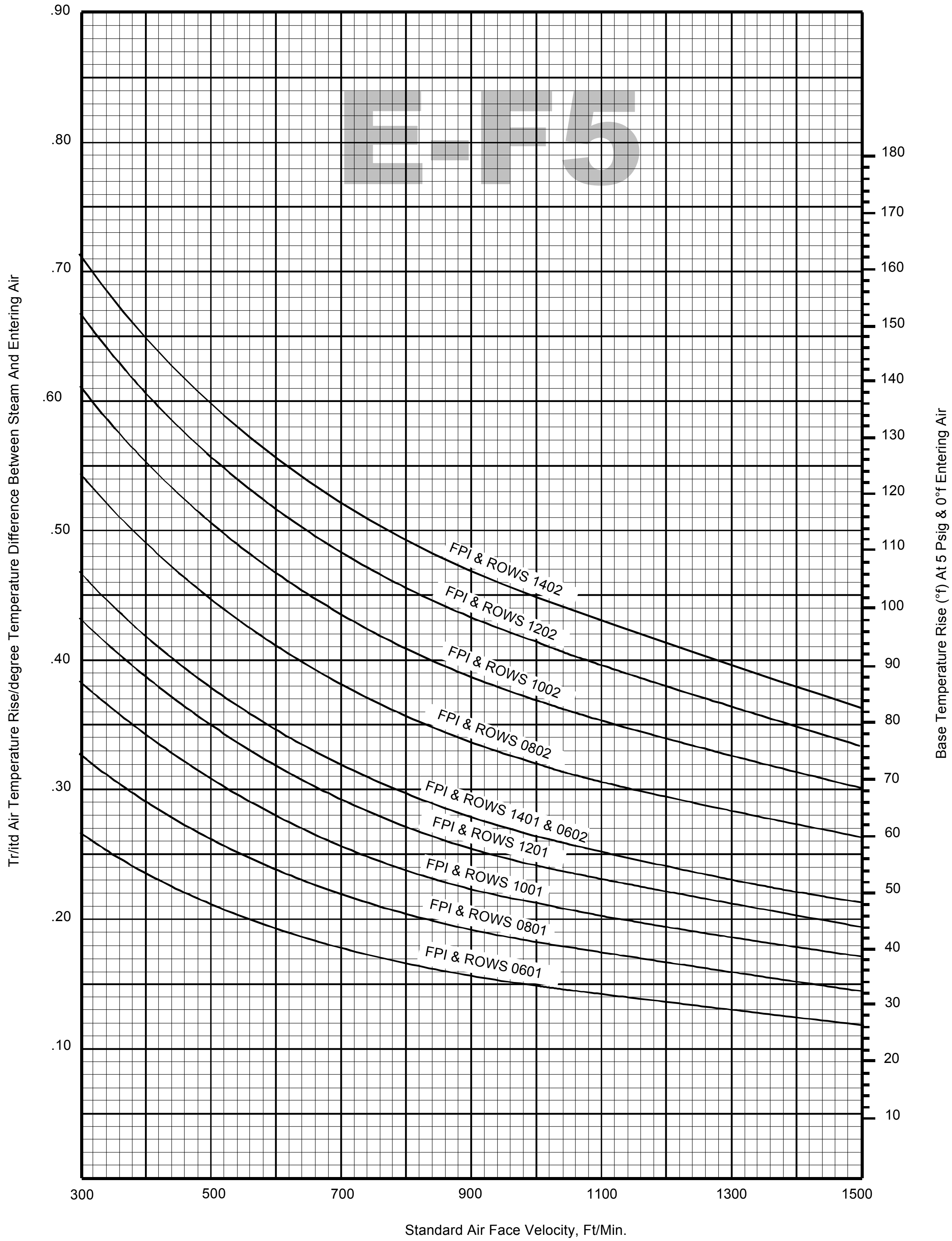
*Figure 4: Steam Capacity Curves for HI-F5 Coils - 5SA & 5HA**



NOTE: 5J/G coils may have slightly less capacity than shown. Use Daikin Tools™ for Contractor Coils Program for optimum selection.

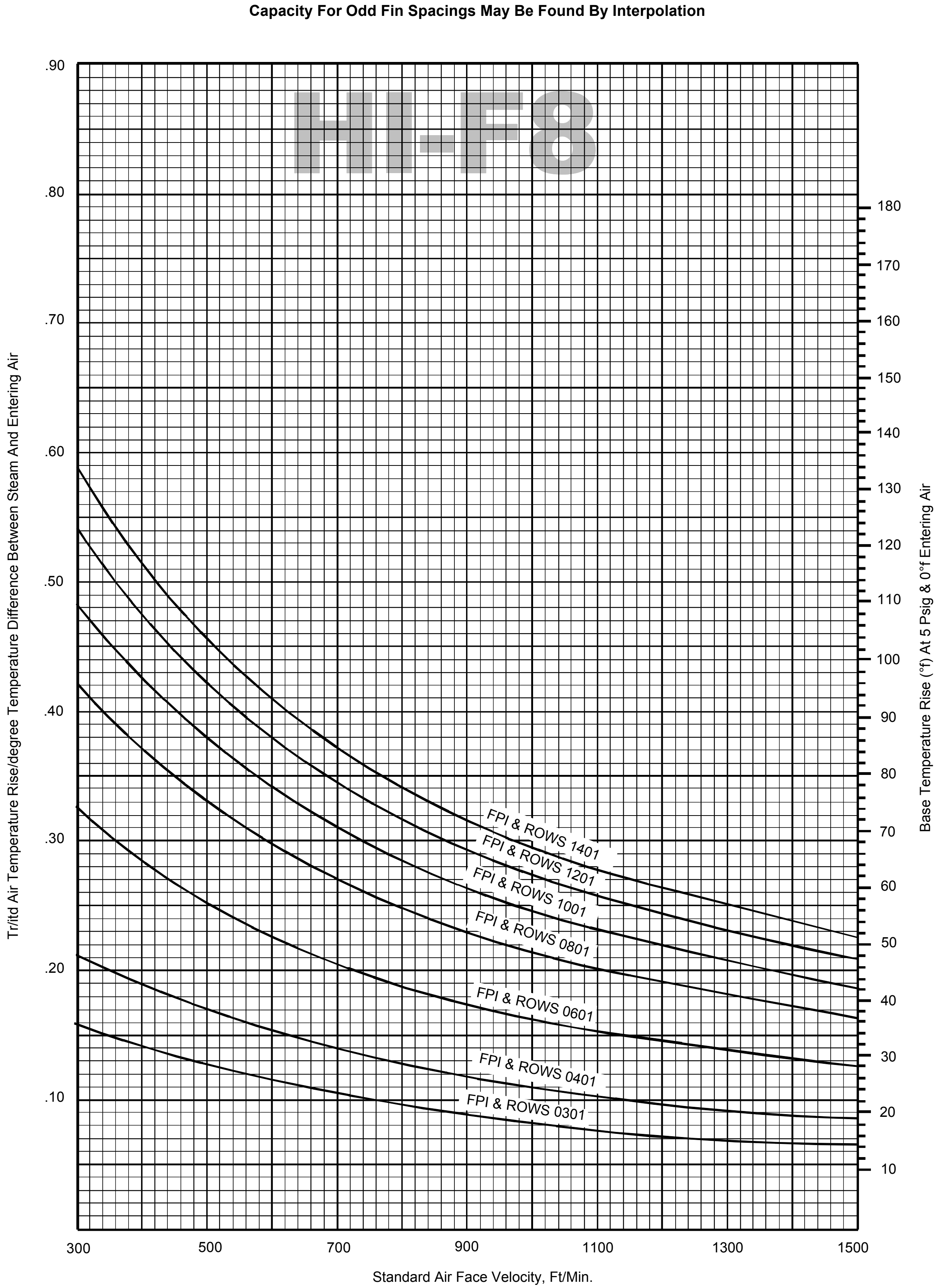
*Figure 5: Steam Capacity Curves E-F5 Coils - 5SA & 5HA**

Capacity For Odd Fin Spacings May Be Found By Interpolation



NOTE: 5J/G coils may have slightly less capacity than shown. Use Daikin Tools™ for Contractor Coils Program for optimum selection.

Figure 6: Steam Capacity Curves for HI-F8 Coils - 8JA, 8RA, 8GA & 8TA



NOTE: 5J/G coils may have slightly less capacity than shown. Use Daikin Tools™ for Contractor Coils Program for optimum selection.

Condensate Loading Factors

Figure 7: 5SA & 5HA Coils

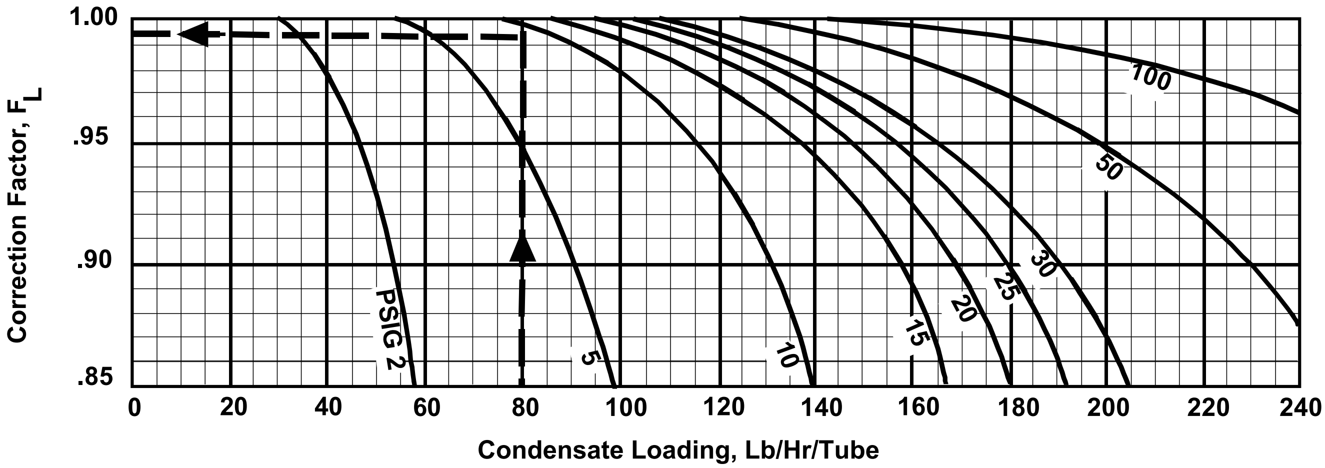


Figure 8: 5JA & 5GA Coils

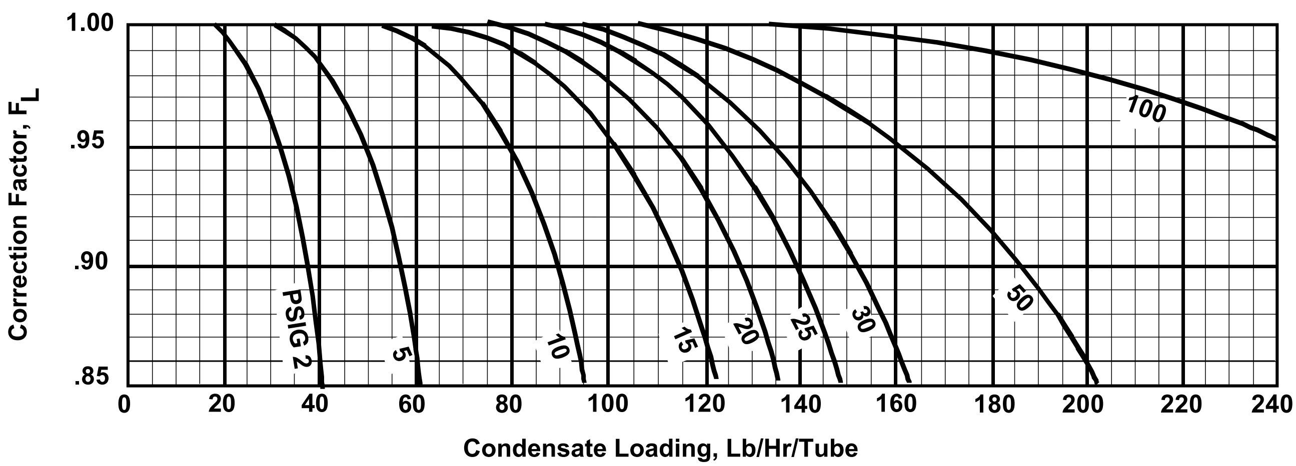
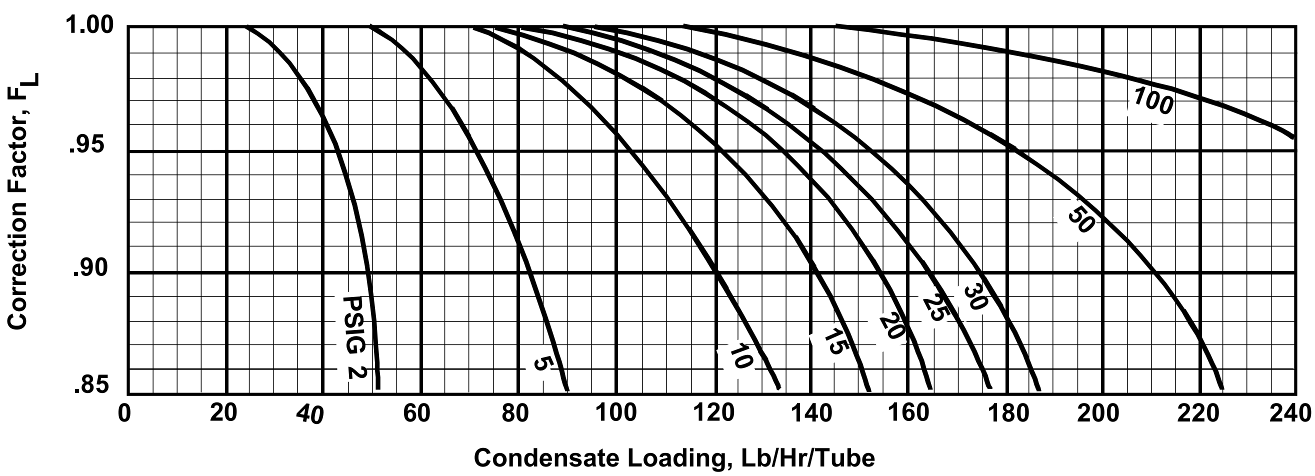
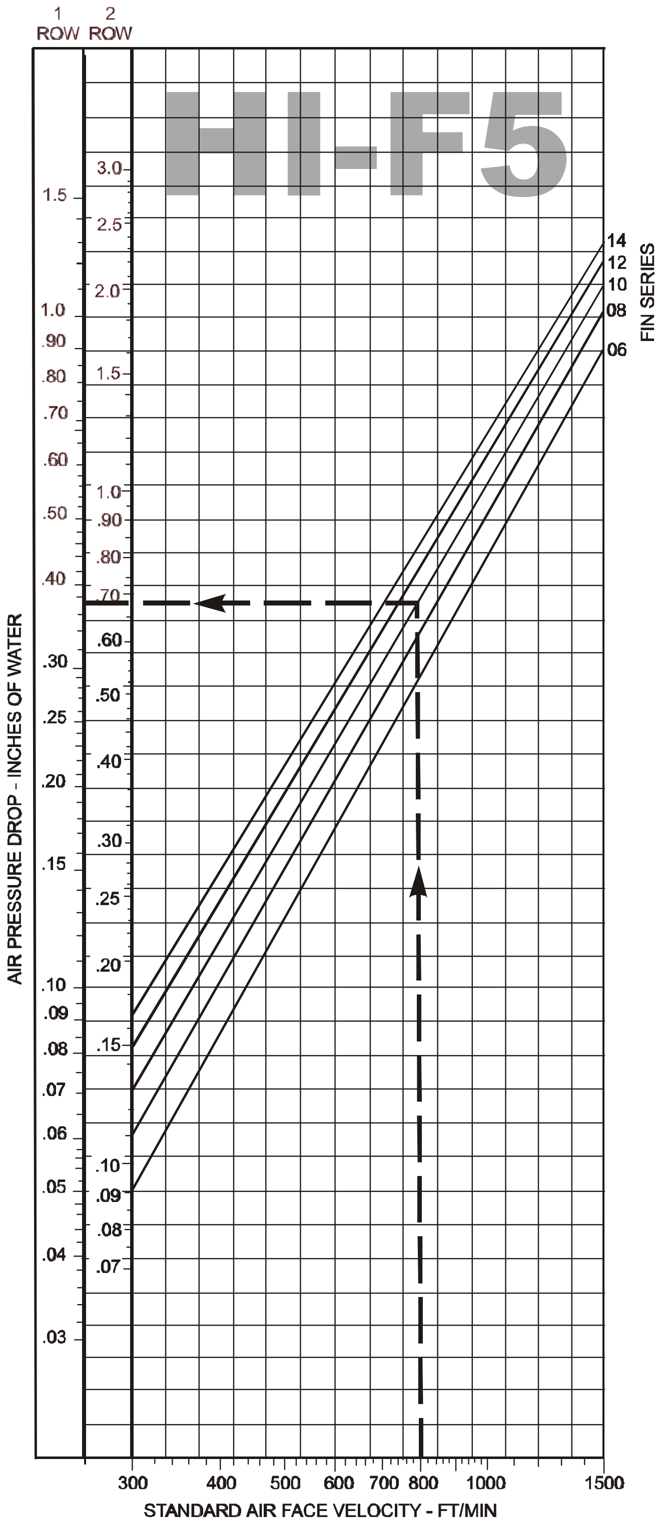


Figure 9: 8JA, 8RA, 8GA & 8TA Coils



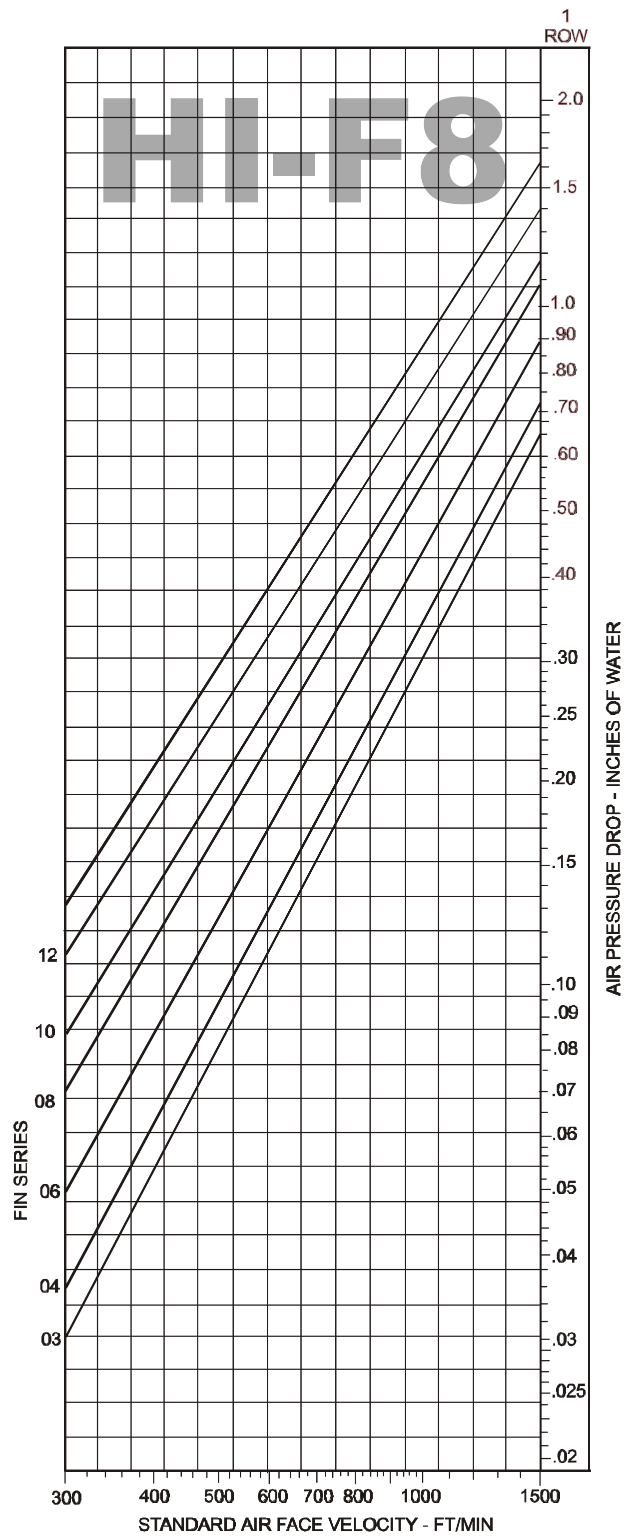
Air Pressure Drop

Figure 10: 5SA, 5HA, 5JA & 5GA Coils



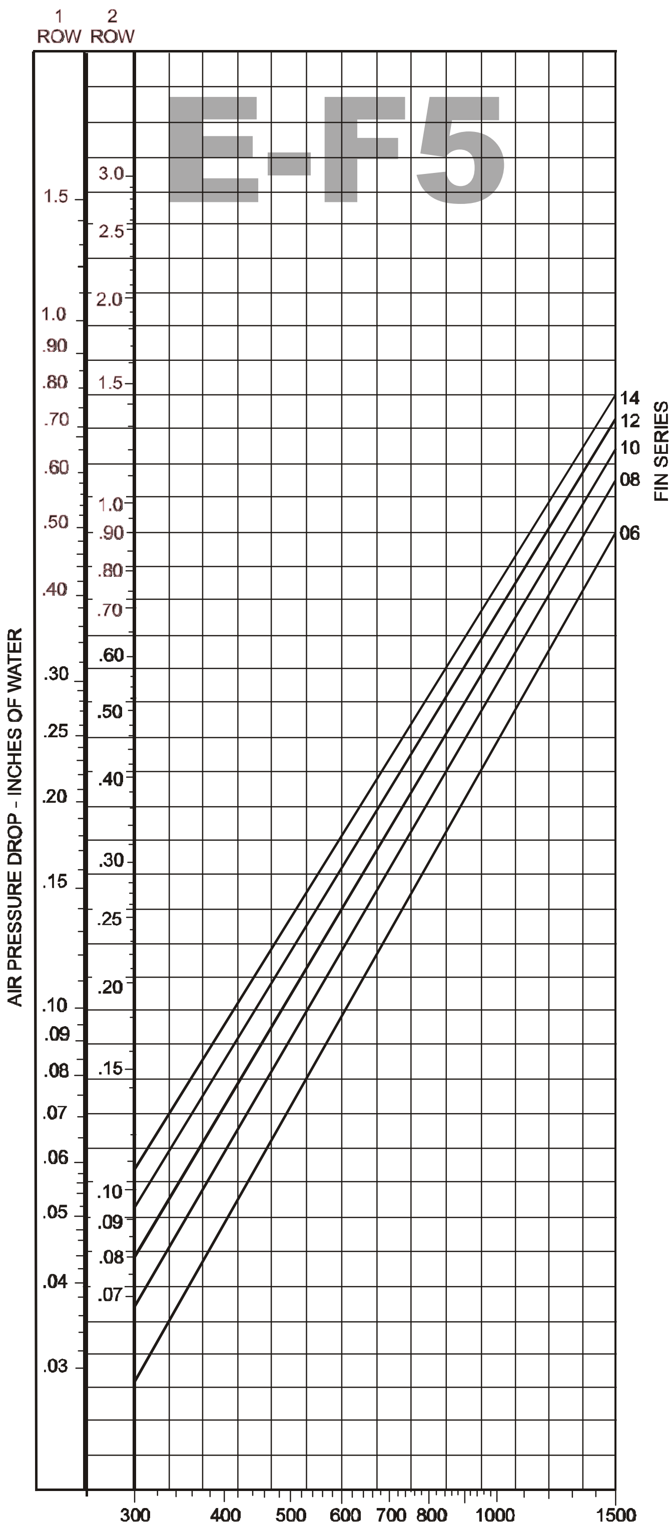
NOTE: Air pressure drop for odd fin spacings may be found by interpolation.

Figure 11: 8JA, 8GA & 8RA Coils



NOTE: Air pressure drop for odd fin spacings may be found by interpolation.

Figure 12: 5SA, 5HA, 5JA & 5GA Coils



NOTE: Air pressure drop for odd fin spacings may be found by interpolation.

Table 2: Steam Conversion Factors (F_S)

Ent. Air Temp	Steam – Pressure – Temperature – Latent Heat																				
	0	212.0°	970.3	0	218.5°	966.1	5	227.1°	960.6	10	239.4°	952.6	15	249.7°	945.6	20	258.8°	939.6	25	266.8°	934.0
-20	1.021			1.050			1.088			1.142			1.187			1.227			1.263		
-15	0.999			1.028			1.066			1.120			1.165			1.205			1.241		
-10	0.977			1.003			1.044			1.098			1.143			1.183			1.219		
-5	0.955			0.984			1.022			1.076			1.121			1.161			1.197		
0	0.933			0.962			1.000			1.054			1.099			1.139			1.175		
5	0.911			0.940			0.978			1.032			1.077			1.117			1.153		
10	0.889			0.918			0.856			1.010			1.055			1.095			1.131		
15	0.867			0.896			0.934			0.988			1.033			1.073			1.109		
20	0.845			0.874			0.912			0.966			1.011			1.051			1.087		
25	0.823			0.852			0.890			0.944			0.989			1.029			1.065		
30	0.801			0.830			0.868			0.922			0.967			1.007			1.043		
35	0.779			0.808			0.846			0.900			0.945			0.985			1.021		
40	0.757			0.786			0.824			0.878			0.923			0.963			0.999		
45	0.753			0.764			0.802			0.856			0.901			0.941			0.977		
50	0.713			0.742			0.780			0.834			0.879			0.919			0.955		
55	0.691			0.720			0.758			0.812			0.857			0.897			0.933		
60	0.669			0.698			0.736			0.790			0.835			0.875			0.911		
65	0.647			0.676			0.714			0.768			0.813			0.853			0.889		
70	0.625			0.654			0.692			0.746			0.791			0.831			0.867		
75	0.603			0.632			0.670			0.724			0.769			0.809			0.845		
80	0.581			0.610			0.648			0.702			0.747			0.787			0.823		
85	0.559			0.588			0.626			0.680			0.725			0.765			0.801		
90	0.537			0.566			0.604			0.658			0.703			0.743			0.779		
100	0.493			0.522			0.560			0.614			0.659			0.699			0.735		

NOTE: To calculate conversion factors not given in the above table, use this formula:

$$\text{Conversion Factor} = \frac{\text{Saturated Steam Temperature - Entering Air Temperature}}{227.1}$$

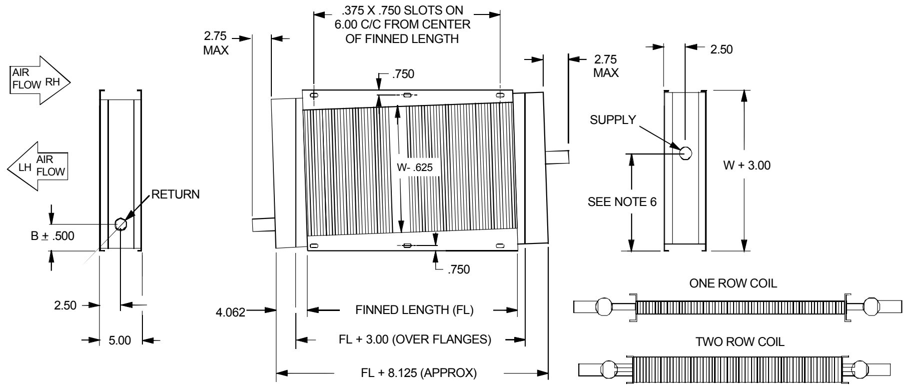
Table 3: Properties of Saturated Steam, BTU/Lb.

PSIG	Temp. (°F)	Latent Heat
2	218.5	966.1
5	227.1	960.6
10	239.4	952.6
15	249.7	945.7
20	258.8	939.6
25	266.8	934.0
30	274.0	929.0
40	286.7	919.9
50	297.7	911.8
60	307.3	904.7
70	316.0	898.0
80	323.9	891.9
90	331.2	886.2
100	337.9	880.8
125	352.9	868.3
150	365.9	857.2
175	377.4	846.9
200	387.8	837.5

Table 4: Number of Tubes Fed

Coil Type	Rows	Fin Height (FH), Inches										
		12	15	18	21	24	27	30	33	36	39	42
8JA, 8RA, 8GA, 8TA	1	4	5	6	7	8	9	10	11	12	13	14
5SA, 5JA, 5HA, 5GA	1	8	10	12	14	16	18	20	22	24	26	28
	2	15	19	23	27	31	35	39	43	47	51	55

Figure 13: 5SA, 5HA, 8RA & 8TA Cased Coils

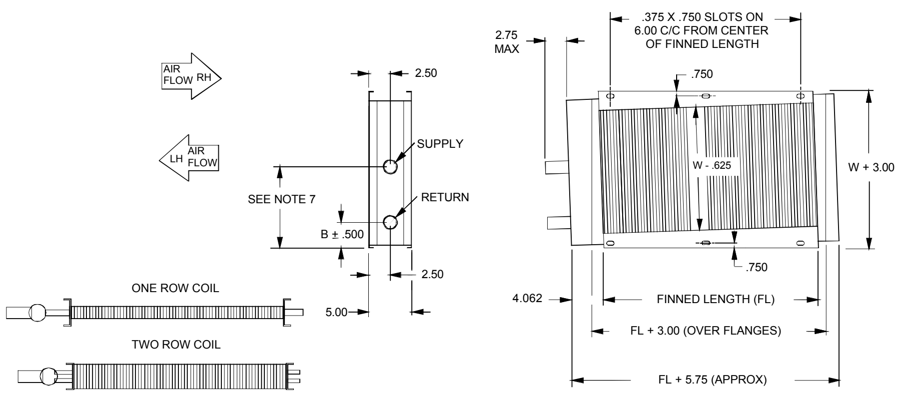


Model	Row	Supply Conn Size	Return Conn Size	B	W
5SA, 5HA	01	1-1/2	1-1/2	2.25	12.00–18.00
5SA, 5HA	01	2	1-1/2	2.25	21.00–42.00
5SA, 5HA	02	2-1/2	2-1/2	2.75	12.00–42.00
8RA, 8TA	01	2-1/2	2-1/2	2.75	12.00–42.00

General Notes:

1. Horizontal air flow.
2. All coils drainable.
3. Connections are pipe, NPT (ext.)
4. All dimensions are in inches.
5. Connection location ± 0.125.
6. 0.125 to 0.562 above coil center line.
7. Tubes are pitched toward return connection.
8. Steam distributng inner tubes (8RA & 8TA).

Figure 14: 5JA, 5GA, 8JA & 8GA Cased Coils



Model	Row	Conn Size	B	W
5JA, 5GA	01	2	2.50	12.00–42.00
5JA, 5GA	02	2-1/2	2.75	12.00–42.00
8JA, 8GA	01	2-1/2	2.75	12.00–42.00

General Notes:

1. Horizontal air flow.
2. All coils drainable.
3. Connections are pipe, NPT (ext.)
4. All dimensions are in inches.
5. Connection location ± 0.125
6. Steam distributing inner tubes.
7. 0.125 to 0.562 below coil center line.
8. Tubes are pitched toward return connection.

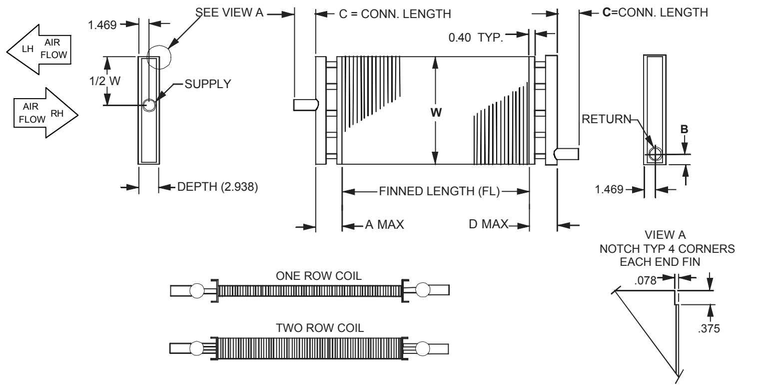
Nomenclature: 5 S A

Tube Diameter
5 = 5/8 inch O.D.
8 = 1 inch O.D.

Coil Type:
S = Standard construction, Fig. 15 & 16 with single tube
J = Standard construction, Fig. 15 & 16 with distributing tube
R = Standard construction, Fig. 15 & 16 with distributing tube
H = High pressure construction, Fig. 15 & 16 with single tube
G = High pressure construction, Fig. 15 & 16 with distributing tube
T = High pressure construction, Fig. 15 & 16 with distributing tube

Tube Centers:
A = 1-1/2 inch (except all HIF8 coils are 3" CC)

Figure 15: 5SA, 5HA, 8RA & 8TA Uncased Coils



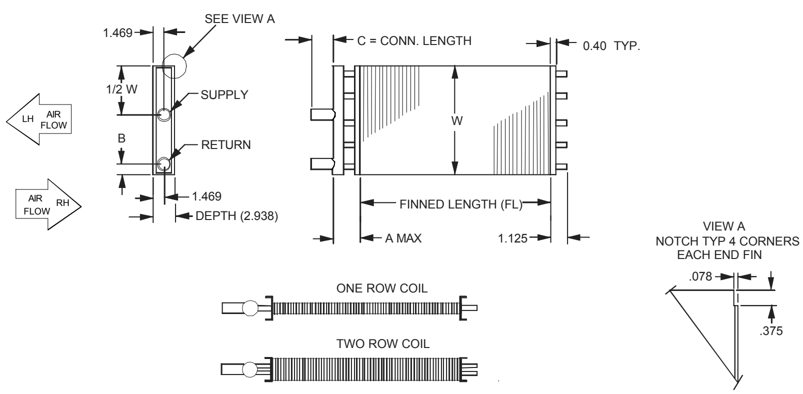
Conn Length	
Option	C
Contractor	3.00
Std. Unit	7.00
Lined Unit	8.50
Vision Unit	8.50

Model	Row	Supply Conn Size	Return Conn Size	A	B	D	W
5SA, 5HA	01	1-1/2	1-1/2	3.25	1.125	3.25	12.00–18.00
5SA, 5HA	01	1-1/2	1-1/2	3.75	1.125	3.25	21.00–42.00
5SA, 5HA	02	2-1/2	2-1/2	3.875	1.625	3.875	12.00–42.00
8RA, 8TA	01	2-1/2	2-1/2	3.875	1.625	3.875	12.00–42.00

General Notes:

1. Horizontal air flow.
2. All coils drainable.
3. Connections are pipe, NPT (ext.)
4. All dimensions are in inches.
5. Connection location ± 0.125.
6. Steam distributing inner tubes (8RA & 8TA).

Figure 16: 5JA, 5GA, 8JA & 8GA Uncased Coils



Conn Length	
Option	C
Contractor	3.00
Std. Unit	7.00
Lined Unit	8.50
Vision Unit	8.50

Model	Row	Conn Size	A	B	W
5JA, 5GA	01	2	3.75	1.375	12.00–42.00
5JA, 5GA	02	2-1/2	3.875	1.625	12.00–42.00
8JA, 8GA	01	2-1/2	3.875	1.625	12.00–42.00

General Notes:

1. Horizontal air flow.
2. All coils drainable.
3. Connections are pipe, NPT (ext.)
4. All dimensions are in inches.
5. Connection location ± 0.125
6. Steam distributing inner tubes.

NOMENCLATURE: 5 S A

Tube Diameter
5 = 5/8 inch O.D.
8 = 1 inch O.D.

Coil Type:
S = Standard construction, Fig. 17 & 18 with single tube
J = Standard construction, Fig. 17 & 18 with distributing tube
R = Standard construction, Fig. 17 & 18 with distributing tube
H = High pressure construction, Fig. 17 & 18 with single tube
G = High pressure construction, Fig. 17 & 18 with distributing tube
T = High pressure construction, Fig. 17 & 18 with distributing tube

Tube Centers:
A = 1-1/2 inch (except all HIF8 coils are 3" CC)

Application Recommendations

Satisfactory operation and service are best provided when coils are installed with proper piping, trap, and support arrangement. The following notes and diagrams are recommended.

General

1. Provide separate supports and hangers for the coil and for the piping.
2. Be certain that adequate piping flexibility is provided. Stresses resulting from expansion of closely coupled piping and coil arrangement can cause serious damage. Coils having opposite end connections must be piped with expansion joints.
3. Standard coils are pitched in the casings when installed for horizontal airflow. The installation should be checked to ensure that the casing is level. On vertical airflow applications, the coils must be pitched when installed.
4. Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to the trap.
5. Install vacuum breakers on all applications to prevent retaining condensate in the coil. Generally, the vacuum breaker is to be connected between the coil inlet and the return main, as shown. However, for a system with a flooded return main, the vacuum breaker should be open to the atmosphere and the trap design should allow venting of large quantities of air.
6. Do not drip supply mains through the coil.
7. Do not attempt to lift condensate when using modulating or ON-OFF control.

Controls

1. With coils arranged for series airflow, a separate control is required on each bank, or coil, in the direction of airflow.
2. On high pressure installations, a two-position steam valve with a face and bypass arrangement is preferred where modulating control is required.
3. Modulating valves must be sized properly. DO NOT UNDERSIZE.

Traps

1. Size traps in accordance with trap manufacturer's recommendations. Be certain that the required differential will always be available. DO NOT UNDERSIZE.
2. Float and thermostatic or bucket traps are recommended for low pressure steam. On high pressure systems, bucket traps are normally recommended. The thermostatic traps should be used only for air venting.
3. Bucket traps are recommended for use with ON-OFF control only.
4. Locate traps at least 12 inches below the coil return connection.
5. Multiple coil installation:
   a. Each coil or group of coils that is individually controlled must be individually trapped.
   b. Coils in series — separate traps are required for each coil, or bank of coils, in series.
   c. Coils in parallel — a single trap may generally be used but an individual trap for each coil is preferred.

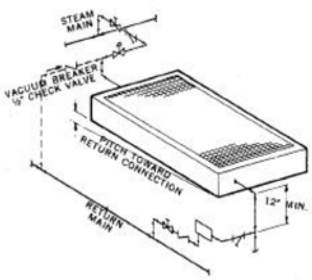
Freezing Conditions

(Entering air temperatures below 35°F)

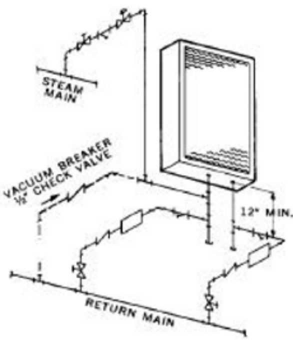
1. 5JA, 8JA and 8RA coils are definitely recommended.
2. 5 psi steam must be supplied to coils at all times.
3. Modulating valves are not recommended. Control should be by means of face and bypass dampers.
4. Consideration should be given to the use of two or three coils in series with two-position steam control valves on that coil or coils which will be handling 35°F or colder air. The desired degree of control can be attained with a modulating valve on the downstream coil.
5. Provision should always be made to thoroughly mix fresh air and return air before it enters coil. Also, temperature control elements must be properly located to obtain true air mixture temperatures.
6. As additional protection against freeze-up, the trap should be installed sufficiently far below coil to provide an adequate hydrostatic head to help remove of condensate during an interruption in the steam pressure. Estimate 3 feet for each 1 psi of trap differential required.
7. On startup, admit steam to coil ten minutes before admitting outdoor air.
8. Provisions must be made to close fresh air dampers if steam supply pressure falls below minimum specified.

Symbols for Piping Arrangements

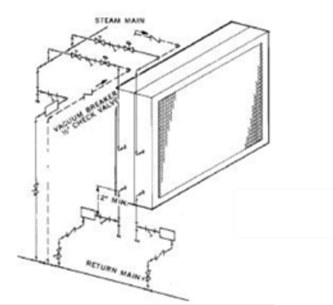
Low Pressure (to 25 PSI)



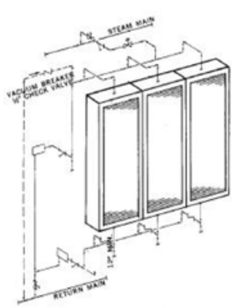
5JA or 8JA coil installed with tubes vertical. The coil supply piping must be dripped ahead of the coil on an installation of this type.



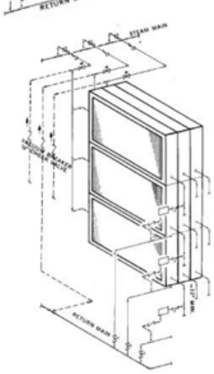
5SA coil installed for vertical airflow. Installer must pitch coil toward the return connection on vertical airflow installations. For horizontal airflow installation, the required pitch is built into the casing.



5JA or 8JA coil installed in series. Note that each coil must have a separate control valve and trap.

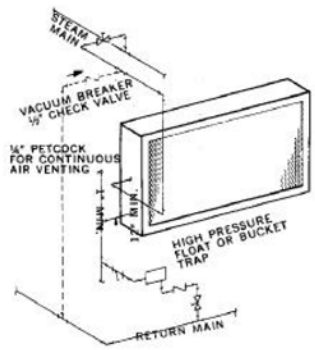


5SA coils installed with tubes vertical. Diagram shows single trap; however, it is always preferable to trap each coil individually.

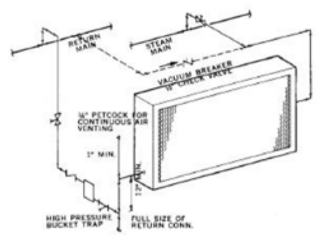


8RA and 5SA coils banked three high by three deep. Individual trapping of each coil as shown is preferred. Note that it is necessary to provide a separate control valve for each bank in the direction of airflow.

High Pressure (over 25 PSI)



5GA or 8GA coils. Note the addition of a vacuum breaker to permit the coil to drain during shutdown.



8TA or 5HA coils. Condensate is lifted to overhead return main.

NOTE: Rating data is AHRI certified only for the standard AHRI coil orientation; i.e., horizontal tubes, vertical coil face and horizontal airflow.

Steam Coils

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Steam Heating Coil(s).

1. 5SA, 5HA, 5JA, 5GA, 8JA, 8GA, 8RA, 8TA Coil Types.

1.02 SUBMITTALS

A. Shop Drawings: Indicate coil fin height & length AND overall height, length and depth, connection sizes & location, flange mounting dimensions, and direction of airflow.

B. Product Data.

1. Certification - Acceptable coils are to be certified in accordance with ARI Standard 410 and bear the ARI label. Coils exceeding the scope of the manufacturer's certification and/or the range of ARI's standard rating conditions will be considered provided the manufacturer is a current member of the ARI Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with ARI Standard 410. Manufacturer must be ISO 9002 certified.
2. Identify fin, tube & casing material type and thickness.
3. Show coil weight (shipping & operating).
4. State air flow amount and its associated pressure drop.
5. Show steam pressure and condensate load.
6. Indicate entering & leaving air temperatures.

1.03 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing steam heating coils specified in this section must show a minimum five years experience and issues complete catalog data.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site on factory-installed shipping skids. Inspect for damage.

C. Store in a clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Daikin Applied.

B. Super Radiator.

C. Trane.

D. Carrier.

E. York.

2.02 GENERAL DESCRIPTION

A. Furnish as shown on plans and as described in the specification, Daikin Applied Steam Heating Coils.

B. Coils to have extended surface, staggered tube, and plate fin design.

2.03 HEADERS

A. Made of non-ferrous seamless copper tubing (low pressure) or cupro-nickel tubing (high pressure) to assure compatibility with primary surface.

B. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with condensate loading requirements.

C. Rolled in joints or dissimilar metals are not acceptable.

2.04 CONNECTIONS

A. Coil connection should be compatible with the piping to the coil to minimize chance of "galvanic action/ electolysis".

B. Connections shall be a diameter adequate to handle steam and condensate loading.

1. The connections are located to permit universal mounting of the coil and assure equal pressure through all the circuits.

C. Connection and material type.

1. Connection material to be [carbon steel] [carbon steel pipe] [copper tube] [red brass]. Connection type to be [threaded] [butt welded] [outside diameter male (ODM) sweat] [Victaulic].

D. Supply steam connections will be located in the center of the coil height and condensate return located at the bottom of the coil.

E. Coils can slide in from either side of ductwork without affecting performance.

2.05 TESTING AND PRESSURE RATINGS

A. Completed coils are tested at a minimum of 315 PSIG air pressure while submerged in warm water.

B. Hydrostatic tests alone are not acceptable.

C. Low pressure steam coil construction is rated for 150 PSIG working pressure at 366 degrees F. High pressure steam coils are rated for 350 PSIG working pressure at 450 degrees F.

2.06 CAPACITY

A. Coil capacity shall be as outline on the project schedule and confirmed with computer generated output.

2.07 PRIMARY SURFACE

A. [5/8"] [1"] diameter tubes shall be staggered in direction of airflow and on [1-1/2"] [3"] tube centers. Wall thickness to be [0.020"] [0.025"] [0.035"] nominal [copper] [cupro-nickel].

B. Tubes to be mechanically expanded in to fin collars to provide a continuous primary to secondary compression bond over entire coil length, assuring maximum heat transfer.

2.08 SECONDARY SURFACE

A. Plate style fins shall be corrugated for high capacity and structural strength.

   1. Fin thickness shall be [0.0075"] [0.0120"] [0.0095"] [0.006"] [aluminum] [copper].

B. The fins to have collars to determine fin spacing per inch and support the heat transfer bond to primary surface. Tubing should not be visible between the fins.

   1. Fin Style to be a [Flat] [New Ripple] [Hi-F] fin type.

2.09 COIL TYPE & CONNECTION LOCATION

A. [5SA - Low Pressure, single tube construction with opposite end connections.] [5HA - High pressure, single tube construction with opposite end connections.] [5JA - Low pressure, jet tube steam distributing construction with same end connections.] [5GA - High pressure, jet tube steam distributing construction with same end connections.] [8JA - Low pressure, jet tube steam distributing construction with same end connections.] [8GA - High pressure, jet tube steam distributing construction with same end connections.] [8RA - Low pressure, jet tube steam distributing construction with opposite end connections.] [8TA - High pressure, jet tube steam distributing construction with opposite end connections.]

B. Steam coils available from 12" to 42" fin height on 3" increments.

C. Steam coils available pitched in casing 1/8" per foot from 12" to 129" fin length in two decimal point increments. For steam coil lengths greater than 129" coils will be unpitched and require the coil to be field pitched for proper condensate drainage.

2.10 CASINGS

A. Casing Style & Material

   1. [Contractor Coil with flanged casing.] [Contractor Coil uncased.] [Air Handler unit coil w/ flanged [stainless] [galvanized] steel casing designed for LSL/MSL replacement applications.] [Air Handler unit coil uncased designed for LSL/LHD replacement applications.]

B. Cased coils are to be pitched a minimum of 1/8" per foot to assist in condensate removal. Cased coils shall have a floating core designed to allow for expansion and contraction.

2.11 PROTECTIVE COATINGS

A. [None, specified coil and casing material only.] [Entire coil assembly coated with an Electro Fin coating. The coating shall be electrodeposited to obtain a nominal dry film thickness of 0.001" +/- 0.0002" (mils). The coating shall be free from voids, checks, cracks, and blisters. The quality and application shall be such that any portion of the coil will meet a minimum 2000 hours of 5% salt spray testing to American society for Testing and materials (ASTM) B117 under the following criteria: A) No loss of coating adhesion and no evidence of attack to the fin proper. Only 5% of the fin collars may show corrosion product. B) Complete deterioration of the sample in any location is considered failure of the part on this test, and shall be cause for rejection.]

2.12 PACKAGING

A. [Coil(s) to be fully crated in a wood enclosure with protective cardboard covering the finned area.] [Coil(s) to be fully crated in a wood enclosure with protective cardboard covering the finned area. The wood enclosure shall be capable of being removed and re-used (Note: Must be used for coated coils.)]

PART 3: EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

Daikin Applied Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority. For training information on all Daikin HVAC products, please visit us at www.DaikinApplied.com and click on Training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied Representative for warranty details. To find your local Daikin Applied Representative, go to www.DaikinApplied.com.

Aftermarket Services

To find your local parts office, visit www.DaikinApplied.com or call 800-37PARTS (800-377-2787). To find your local service office, visit www.DaikinApplied.com or call 800-432-1342.

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