HEATCRAFT

Fluid Coils

Cooling applications are most commonly used in chilled fluid systems for comfort conditioning of a forced air stream and in process systems for dehumidification processes. A large variety of drainable circuiting options makes this a good choice for most general heat transfer applications. For use with water, glycols, brines, thermal oils or ammonia.

Desaturation Coils

TWO COILS IN ONE. A combination cooling/reheat coil in one common case that will both dehumidify the air and reheat that same air to the desired leaving air temperature and humidity level in low comfort cooling applications such as hospitals, clean rooms, and science or research laboratories. A single supply and return connection is used thus saving end users and installing contractors' significant equipment, piping and labor costs. One coil is required thus saving the end user the cost of purchasing a second coil. Also, potential reduction in APD.WPD = Reduced Hp=Energy Savings = Bottom Line Dollar Savings

FLUID COIL CONSTRUCTION

Tubing	3/8" or 1/2" O.D. Copper, 5/8" O.D. Copper, Cupronickel, Stainless Steel, Carbon Steel or Admiralty Brass
Circuiting	Quarter, Half, Three Quarter, Single, One and one half, Double, Triple or Custom
Rows	Quarter, Half, Three Quarter, Single, One and one half, Double, Triple or Custom
Fin Surface	Sine Wave (corrugated), New Ripple (peak and valley) or Flat
Casing	Galvanized Steel, Stainless Steel, Carbon Steel, Copper or Aluminum
Connections	Carbon Steel, Stainless Steel, Red Brass, or Copper Sweat (MPT, FPT, Victaulic, Grooved or Welded)
Vents & Drains	Standard on all coils.

Hot Water Coils

Heating applications are most commonly used in hot fluid systems for comfort conditioning of a forced air stream and in process systems for drying processes. The collector header design with internal baffles provides circuiting flexibility while eliminating the need for return bends, while the splayed header design uses return bends for circuiting in lieu of a collection header. The term "splayed" means that the coil headers are offset outward from the coil tubes. The splayed header coil always has same end connections.

Cleanable Fluid Coils

Cleanable applications are commonly used where mechanical cleaning of the coil tubes is required. One and two row coils are furnished with removable brass threaded plugs on either or both ends. Multi-row coils utilize a removable steel head plate in lieu of coil headers. This plate contains baffles to provide coil circuitry and is removable for easy access to coil tubes. Cleanable options include cleanable from the supply connection end, cleanable from the end opposite the supply connection, or cleanable from both ends.

HEATCRAFT FLUID COIL SPECIFICATION

1.0 CERTIFICATION

Acceptable coils are to have ARI Standard 410 certification and bear the ARI symbol. 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 program and the coils have been rated in accordance to ARI Standard 410. Manufacturer must be ISO 9002 certified.

1.1 FLUID COIL DESIGN PRESSURES AND TEMPERATURES

Coils shall be designed to withstand 250 psi maximum operating pressures and a maximum fluid temperature of 300°F for standard duty copper tube coils. Optional high pressure construction will include cupronickel tubes and headers to increase maximum operating pressure to 350 psi and maximum operating temperature to 450°F. For cleanable coils with removable heads, coils shall be designed to withstand 100 psi maximum operating pressures and a maximum fluid temperature of 150°F. Higher limits are available, depending on coil construction and/or materials used.

1.2 FACTORY TESTING REQUIREMENTS

Coils shall be submerged in water and tested with a minimum of 315 psi air pressure for standard copper tube coils and 125 psi for cleanable coils with removable heads. A 500 psig hydrostatic and shock test is required for high pressure cupronickel construction. Coils must display a tag with the inspector's identification as proof of testing.

1.3 FINS

Coils shall be of plate fin type construction providing uniform support for all coil tubes. Stainless steel fins shall be constructed of 304 & 316 stainless. Carbon steel fins shall be constructed of ASTM A109-83. Coils are to be manufactured with die-formed aluminum, copper, stainless steel or carbon steel fins with self-spacing collars which completely cover the entire tube surface. The fin thickness shall be 0.0075 +/- 5% unless otherwise specified. Manufacturer must be capable of providing self-spacing die-formed fins 4 through 14 fins/inch with a tolerance of +/- 4%.

1.4 TUBING

Tubing and return bends shall be constructed from UNS 12200 seamless copper conforming to ASTM B75 and ASTM B251 for standard pressure applications. High pressure construction shall use seamless 90/10 Cupronickel alloy C70600 per ASTM B111. Stainless steel tubes shall be ASTM A249. Carbon steel tubes shall be W&D / ASTM A214 & seamless A179. Copper tube temper shall be light annealed with a maximum grain size of 0.040 mm and a maximum hardness of Rockwell 65 on the 15T scale.

Design permits in-tube water velocities up to 6 ft/s for the standard seamless copper tubing, and up to 8 ft/s for optional seamless alloy C70600 cupronickel tubing.

Tubes are to be mechanically expanded to form an interference fit with the fin collars. Coil tube size and wall thickness' are 5/8"x0.020 and 1/2"x0.016 and 1"x.035 standard for copper, with other options available. Steel tubes are offered as 5/8"x0.035 or 0.049.

1.5 HEADERS

Headers shall be constructed from UNS 12200 seamless copper conforming to ASTM B75 and ASTM B251 for standard pressure applications. High-pressure construction is to incorporate seamless 90/10 Cupronickel alloy C70600 per ASTM B111. Stainless steel will be constructed of 304L & 316L (ASTM-A240) Sch-5 or Sch-10. Carbon steel headers shall be constructed of Sch-10 (ASTM-A135A) or Sch-40 (ASTM A53A) pipe.

Coil return headers are to be equipped with factory-installed 1/2” fpt air vent connection placed at the highest point available on face of the 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.

1.6 CONNECTIONS

Standard construction fluid connections are male pipe thread (MPT) and constructed from red brass conforming to ASTM B43 or Schedule 40 steel pipe as a minimum. Stainless steel will be304L or 316L (ASTM-A240) Sch-40 or Sch 80. Carbon steel will be A53A Sch-40, A106A Sch-40 or Sch-80 or A53B Sch-80 pipe.

1.7 CLEANING

All residual manufacturing oils and solid contaminants are removed internally and externally by completely submersing the coil in an environmentally and safety approved type degreasing solution, which is also chemically compatible with the coil material. This may vary for steel tube coils, depending on the application and/or customer specifications.

1.8 BRAZING

Oxyfuel gas brazing, using fillet rod material of minimum 5% silver, is used for all non-ferrous tube joints to headers and connections. Depending on the application, ferrous to non-ferrous brazing material may contain upwards of 35% silver, or may be Tobin bronze.

1.8.1 WELDING

Gas shielded arc welding is used for welded vessels constructed of stainless steel. Gas welding is used for welded vessels constructed of carbon steel.

1.9 CASING

Coil casing and endplate shall be fabricated from Galvanized steel, as a standard construction, meeting ASTM and UL G90U requirements, Aluminum, 0.080" thick, optional, Copper, 0.063 " thick, optional,16- or 14-gauge carbon steel or stainless steel, optional. double-flange casing shall be provided when coils are specified as vertical stacking.

Standard coil intermediate tube sheets (center tube supports) shall be fabricated from the same gauge sheet stock and material as the end plates, and to the following schedule:

Finned Length (inches)	Number of Tube Sheets
6.00 – 48.00	0
48.01 – 96.00	1
96.01 – 144.00	2
144.01 and greater	4

1.10 CERTIFICATION

Performance certified coils that are ARI Standard 410 listed bear the ARI symbol. Coils exceeding the scope of the certification and/or the range of standard rating conditions are also rated to the extent possible by the ARI Std. 410 method. Luvata continues as a current and active member of the ARI Air-Cooling and Air-Heating Coils certification program, with original coil line certification and computerized selections dating back to 1969.

1.11 AGENCY APPROVAL

Luvata Grenada LLC was facility registered by UL in 1994 to ISO 9002 (ANSI/ASQC Q92). Applicable commercial coil models are UL Standard 207 registered as Refrigerant Containing Components and Accessories; non-electrical. CRN, category H.

Note: Luvata Grenada LLC can provide ASME code stamped vessels.

1.13 INSTALLATION

Coils to be installed in accordance with manufacturer's instructions and any applicable piping codes.

1.14 LEAD TIME

Standard lead-time for custom made retrofit fluid coils of standard construction with OEM circuiting shall be 11-15 working days, with reduced lead-time emergency shipment options of 10 working days and 5 working days from order placement date and based upon production approval.

Standard lead-time for custom made fluid coils of manufacturer's own standard design and circuiting shall be 10 working days, with reduced lead-time emergency shipment options for 5 working days, 48-hours and 24-hours from order placement date.

All coils shall be quoted and offered as FOB Factory, Full Freight Allowed to any and all destinations within the Continental United States.

CERTIFIED DRAWING
1 & 2 ROW HOT WATER CP 1064-D

Customer _____ Customer P.O. Number _____

Job _____

Written by _____ Date _____

Approved by _____ Date _____

#	TAG	QTY	MODEL NUMBER					
			TYPE	FPI	ROWS DEEP	FIN	FH	FL
1								
2								
3								
4								

#	DIMENSIONAL DATA													
	CONNECTION										FLANGES			
	SIZE	A	B	C	E	H	I	J	L	M	R	S	T	W
1														
2														
3														
4														

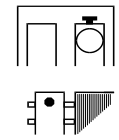
MATERIALS OF CONSTRUCTION	
FINS	AL CU CS St Stl
TUBES	CU CuNi CS St Stl
HEADERS	CU CuNi Carbon Stl St Stl
CONN	CS Red Brass Cu Sweat St Stl
CASING	AL Galvanized Steel CU Stainless Steel

	GENERAL OPTIONS
☐	Inverted Flanges
☐	End Plates Only
☐	Label Kit
☐	Mounting Holes
☐	Phenolic Coating
☐	Turbospirals

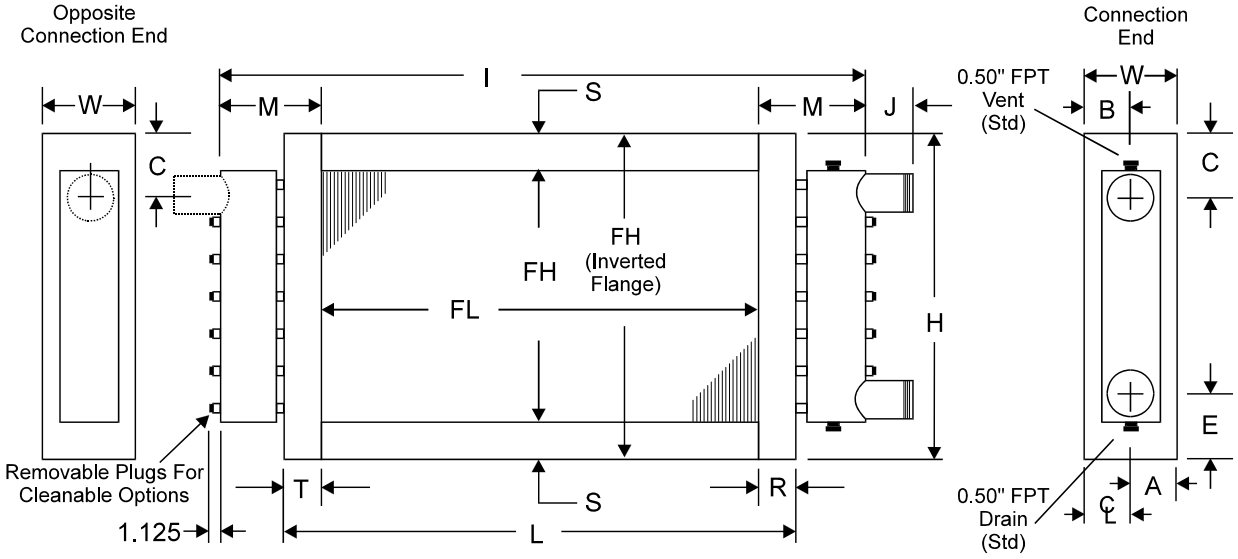
	CONN. & V/D OPTIONS
☐	End Cap 0.125" Tee
☐	Side 0.50" FPT Cpl.
☐	FPT Connections

☐ End Cap

☐ Side



REMARKS:



GENERAL NOTES

1. Coils will vent and drain through factory-installed vent and drain fittings when mounted level for horizontal flow.
2. If S < 1" or End Plates Only Case, vents and drains will be located on the side of the header. Connection locations other than standard could affect vent and drain locations. Consult factory.
3. Mounting holes are optional. 0.375" diameter holes on 6" centers from the centerline of the fin height and finned length are typical for all flanges. Not available with Inverted Flanges or when S<0.75".
4. All dimensions are in inches.
5. Type K coils have removable plugs on both ends.
6. Type P coils have removable plugs on connection end only.
7. Type Q coils have removable plugs on opposite connection end only.
8. With Inverted Flanges or End Plates Only construction, headers will extend a maximum of 0.375" above and below the casing. Vents and drains will be located on the side of the headers.
9. Intermediate tube supports are fabricated from heavy gauge stock and supplied per the chart below.

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

HEATCRAFT™

CERTIFIED DRAWING
FLUID CP 1063-D

Customer _____ Customer P.O. Number _____

Job _____

Written by _____ Date _____

Approved by _____ Date _____

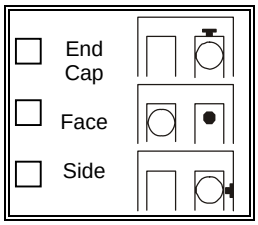
#	TAG	QTY	MODEL NUMBER						HAND
			TYPE	FPI	ROWS DEEP	FIN	FH	FL	Left, Right Universal
1									
2									
3									
4									

#	DIMENSIONAL DATA															
	CONNECTION												FLANGES			
	SIZE	A	B	C	D	E	F	H	I	J	L	M	R	S	T	W
1																
2																
3																
4																

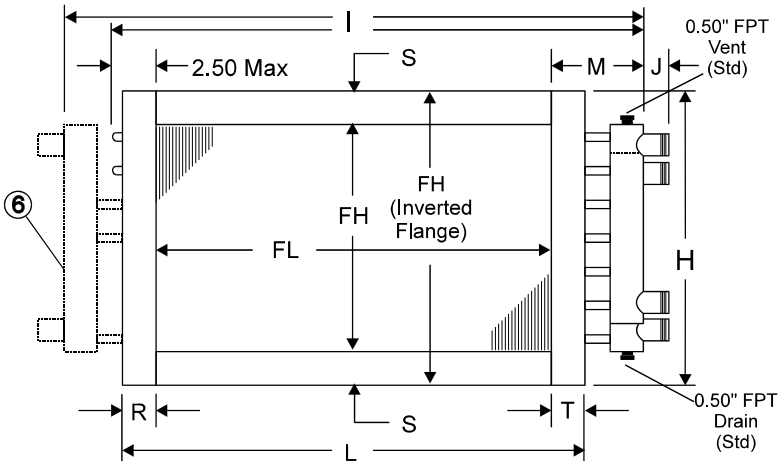
MATERIALS OF CONSTRUCTION	
FINS	AL CU CS St Stl
TUBES	CU CuNi CS St Stl
HEADERS	Cu CuNi Carbon Stl St Stl
CONN	CS Red Brass Cu Sweat St Stl
CASING	AL Galvanized Steel CU Stainless Steel

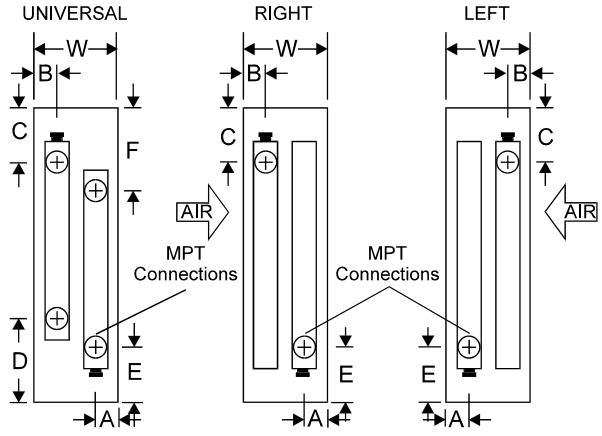
	GENERAL OPTIONS
☐	Inverted Flanges
☐	End Plates Only
☐	Label Kit
☐	Mounting Holes
☐	Phenolic Coating
☐	Turbospirals

	CONN. & V/D OPTIONS
☐	End Cap 0.125" Tee
☐	Face 0.50" FPT Cpl.
☐	Face 0.25" Tee
☐	Face 0.50" MPT 7" Ext.
☐	Side 0.50" FPT
☐	FPT Connections



REMARKS:





GENERAL NOTES

1. Coils will vent and drain through factory-installed vent and drain fittings when mounted level for horizontal flow.
2. If S < 1" or End Plates Only Case, vents and drains will be located on the face or side of the header. Connection locations other than standard could affect vent and drain locations. Consult factory.
3. Mounting holes are optional. 0.375" diameter holes on 6" centers from the centerline of the fin height and finned length are typical for all flanges. Not available with Inverted Flanges or when S < 0.75".
4. All dimensions are in inches.
5. 1.5 and 2 serpentine 3, 4 and 5-row coils. 3 serpentine 6-row, and 5M (splayed header) coils are available only as left- or right-handed.
6. 1 serpentine 3- and 5-row coils, 2 serpentine 6- and 10-row coils, and 9-row coils have supply and return connections on opposite ends. All other serpentine and row configurations have same end connections.
7. The supply line should be connected to the lower connection on the leaving air side for counterflow operation.
8. With Inverted Flanges or End Plates Only Case construction, headers will extend a maximum of 0.375" above and below the casing. Vents and drains will be located on the face of the headers.
9. Intermediate tube supports are fabricated from heavy gauge stock and supplied per the chart below.

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

HEATCRAFT™

CERTIFIED DRAWING
DESATURATION CP 1197-B

Customer _____ Customer P.O. Number _____

Job _____

Written by _____ Date _____

Approved by _____ Date _____

TAG	QTY	MODEL NUMBER	HAND (Left or Right)

PATENT PENDING

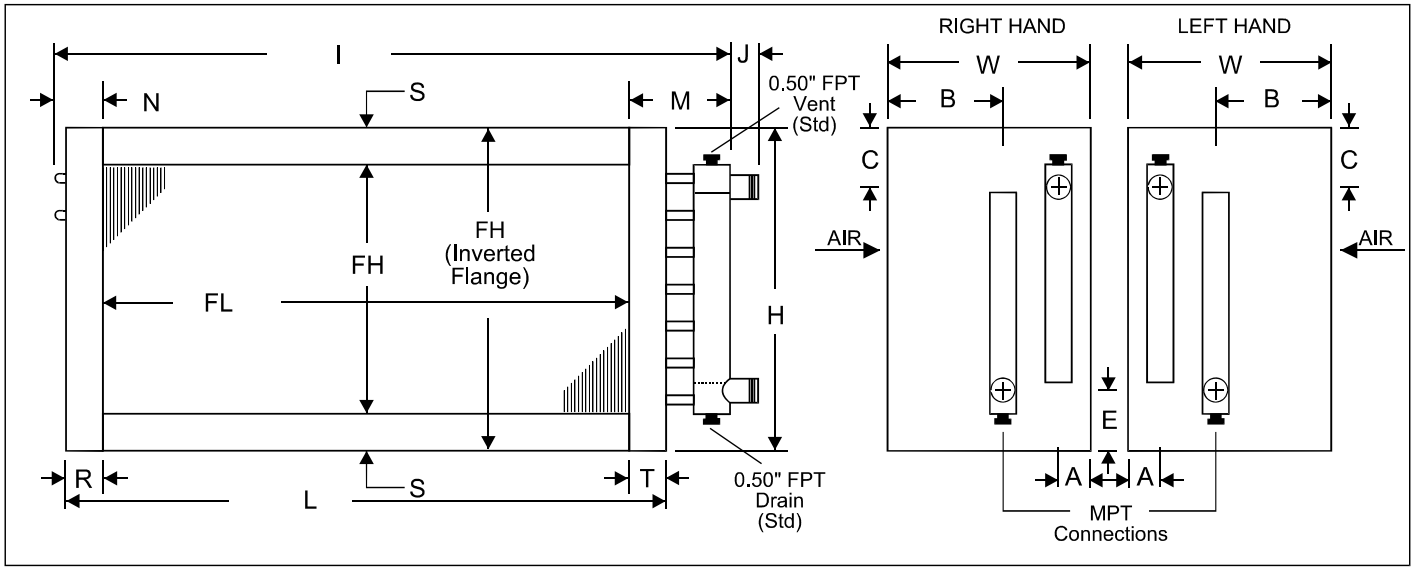
DIMENSIONAL DATA														
CONNECTION											FLANGES			
SIZE	A	B	C	E	H	I	J	L	M	N	R	S	T	W

MATERIALS OF CONSTRUCTION	
FINS 1 FINS 2	AL CU AL CU
TUBES	CU CuNi Adm Brass
HEADERS	CU CuNi Carbon Stl
CONN	CS Red Brass Cu Sweat
CASING	AL Galvanized Steel CU Stainless Steel

	GENERAL OPTIONS
☐	Inverted Flanges
☐	End Plates Only
☐	Label Kit
☐	Mounting Holes
☐	Corrosion Resistant Coating
☐	Turbospirals

	CONN. & V/D OPTIONS
☐	End Cap 0.125" Tee
☐	Face 0.50" FPT Cpl.
☐	Face 0.25" Tee
☐	Face 0.50" MPT 7" Ext.
☐	Side 0.50" FPT
☐	FPT Connections

☐ End Cap
☐ Face
☐ Side



REMARKS:

GENERAL NOTES

1. All dimensions are in inches.
2. Coils will vent and drain through factory-installed vent and drain fittings when mounted level for horizontal flow.
3. If S < 1" or End Plates Only Case, vents and drains will be located on the face or side of the header. Connection locations other than standard could affect vent and drain locations. Consult factory.
4. Mounting holes are optional. 0.375" diameter holes on 6" centers from the centerline of the fin height and finned length are typical for all flanges. Not available with Inverted Flanges or when S < 0.75".
5. The supply line should be connected to the lower connection on the entering air side for counterflow operation.
6. With Inverted Flanges or End Plates Only Case construction, headers will extend a maximum of 0.375" above and below the casing. Vents and drains will be located on the face of the headers.
7. Intermediate tube supports are fabricated from heavy gauge stock and supplied per the chart below.

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

HEATCRAFT™

CERTIFIED DRAWING
CLEANABLE FLUID CP 1070-D

Customer _____ Customer P.O. Number _____

Job _____

Written by _____ Date _____

Approved by _____ Date _____

#	TAG	QTY	MODEL NUMBER						HAND Left Right
			TYPE	FPI	ROWS DEEP	FIN	FH	FL	
1									
2									
3									
4									

GENERAL OPTIONS	
☐	Label Kit
☐	Mounting Holes
☐	Phenolic Coating

#	DIMENSIONAL DATA											
	CONNECTION							FLANGES				
	SIZE	A	E	H	J	L	M	R	S	T	W	FIG#
1												
2												
3												
4												

MATERIALS OF CONSTRUCTION	
FINS	AL CU CS St Stl
Fin Thick	
TUBES	CU CuNi CS St Stl
Tube Size	
HEADERS	CU CuNi CS St Stl
CONN	CS Cu Sweat Red Brass St Stl
CASING	AL CU Galv Stl St Stl

KH, KS, KD
Cleanable
Both Ends

General Notes
8. KH return
9. KS, 4& 8 Row KD return
10. 6 Row KD return

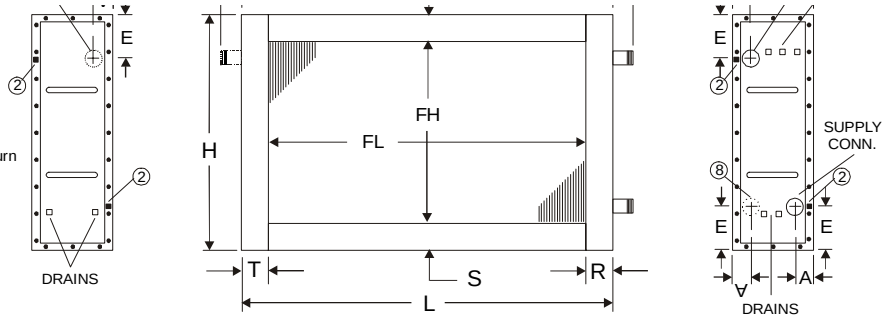


Figure 2

PS, PD
Cleanable
Supply End

General Notes
8. Return connection
9. 6 Row PD return

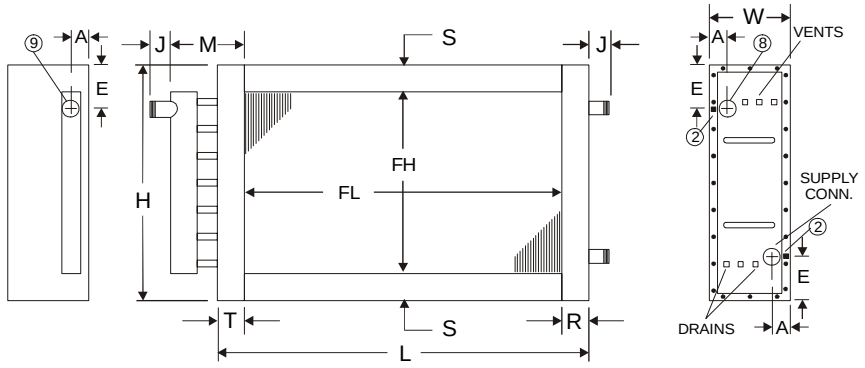
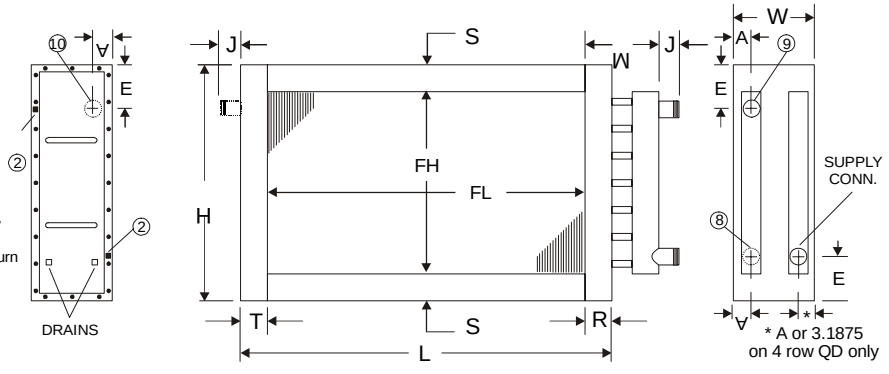


Figure 3

QH, QS,
QD
Cleanable
Opposite
Supply End

General Notes
8. QH return
9. QS, 4& 8 Row QD return
10. 6 Row QD return



REMARKS:

GENERAL NOTES

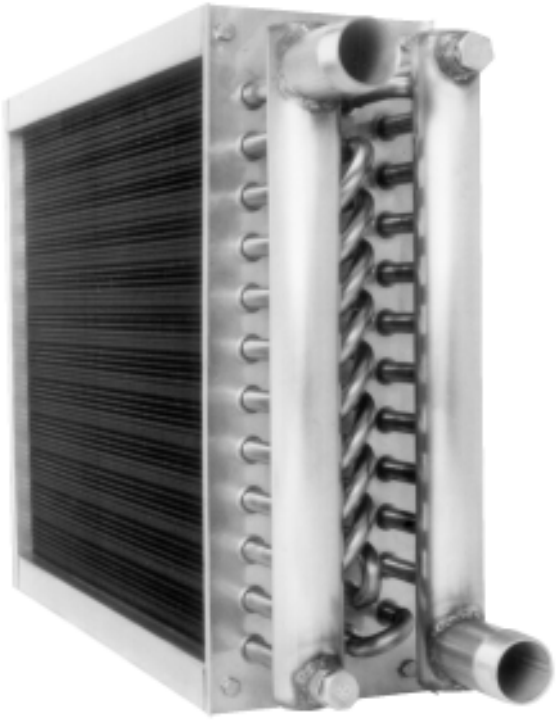
1. Mounting holes are optional. 0.375" diameter holes on 6" centers from the centerline of the fin height and finned length are typical for all flanges. Not available when S < 1".
2. Jackscrews are provided to facilitate head removal.
3. All dimensions are in inches.
4. The supply line should be connected to the lower connection on the leaving air side for counterflow operation.
5. 1" wide reinforcement bars may extend past flanges.
6. Phenolic coated coils require a longer lead-time since they must be re-tested after coating.
7. Intermediate tube supports are fabricated from heavy gauge stock and supplied per the chart to the below.

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

LUVATA

HEATCRAFT

Fluid Coil Installation Operation and Maintenance



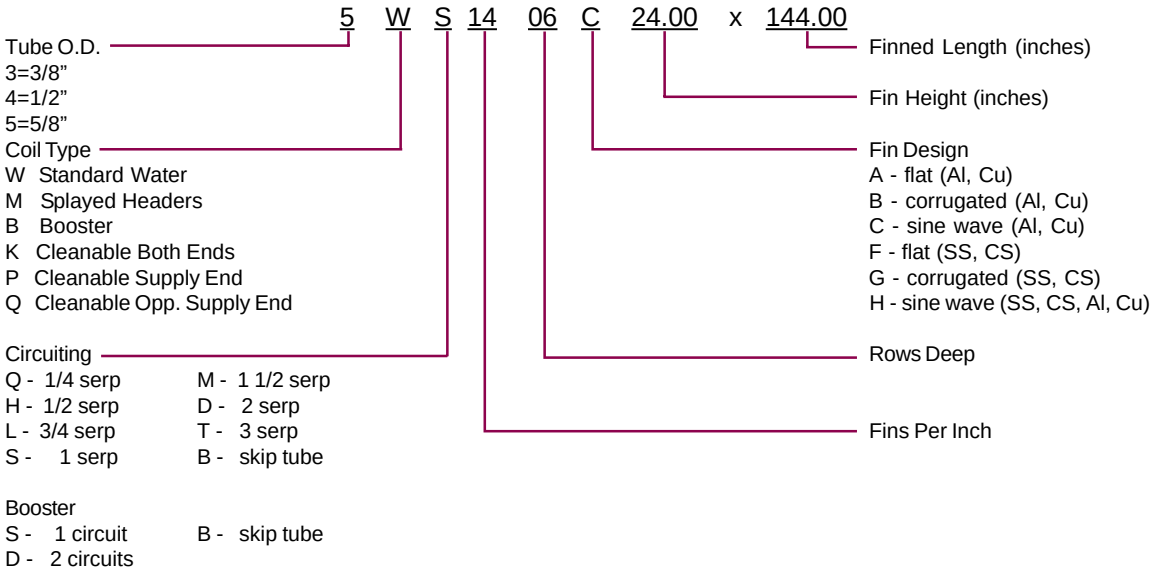
LUVATA GRENADA LLC
PO Box 1457 / 1000 Heatcraft Drive, Grenada, MS 38902-1457
Tel: 800-225-4328 / 662-229-4000 Fax: 662-229-4212
Email: coils@luvata.com
Web Site: www.luvata.com/heatcraft

Guidelines for the installation, operation and maintenance of Heatcraft cooling and heating coils have been provided to help insure the proper performance of the coils and their longevity. These are general guidelines that may have to be tailored to meet the specific requirements of any one job. As always, the installation and maintenance of any coil should be performed by a qualified party or individual. Protective equipment such as safety glasses, steel toe boots and gloves are recommended during the installation and routine maintenance of the coil.

Receiving Instructions

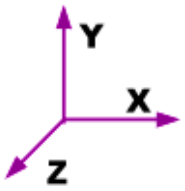
1. All Heatcraft coils are factory tested, inspected and carefully packaged.
2. Damage to the coils can occur after they have left the factory. Therefore, the coils should be inspected for shipping damage upon receipt. The freight bill should also be checked against items received for complete delivery.
3. Damaged and/or missing items should be noted on the carrier's freight bill and signed by the driver.
4. For additional assistance, contact your local Heatcraft coil representative.

Nomenclature



Mounting

	Horizontal Air Flow Horizontal Tubes	Level with the y-axis and x-axis.
	Vertical Air Flow[2] Horizontal Tubes	Level with the z-axis and x-axis.
	Horizontal Air Flow Vertical Tubes	Level with the y-axis and x-axis.

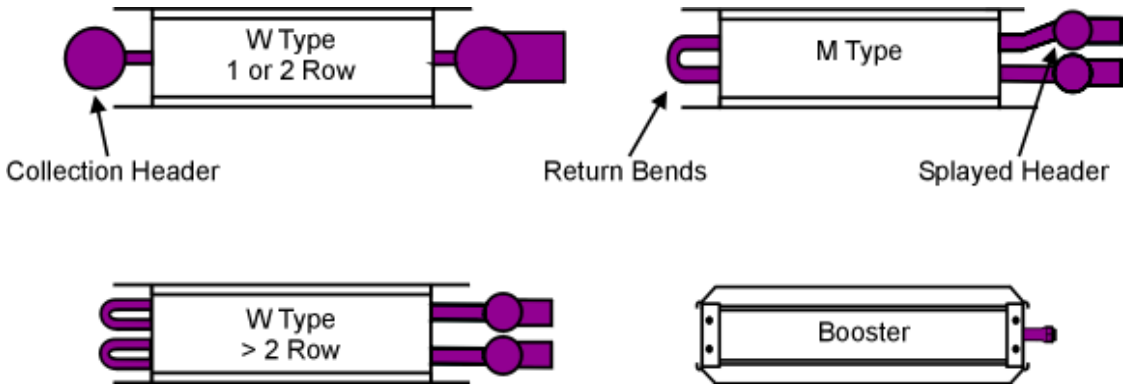


1. All Heatcraft water and glycol coils are designed to be fully drainable when properly mounted.
2. Vertical air-flow is not recommended for dehumidifying coils.

Coil Types

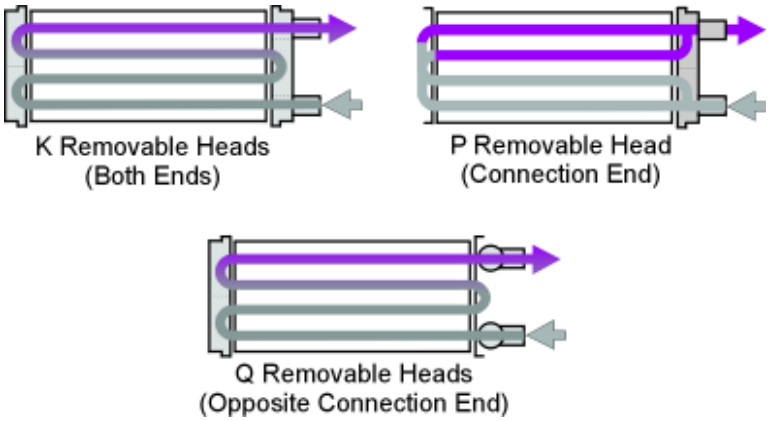
Standard Fluid Coils

Heatcraft fluid coils are specifically designed for your particular application. Flexibility is built into our manufacturing processes, offering variations in fin type, fin density, circuitry arrangement, coil casing and materials of construction. Standard fluid type "W" coils utilize a collection header for one and two row applications and return bends for applications that require three or more rows. Type "M" coils are used for one and two row applications that require same end connections. For type "M" coils the supply and return headers are offset or "splayed." This orientation allows for the supply and return headers to be placed side by side. Booster coils, type "B," are also available for one and two row applications.



Cleanable Fluid Coils

We offer cleanable fluid coils for applications where mechanical cleaning of the internal surface of the tubes are required. Our cleanable coils utilize a box-style head in lieu of cylindrical headers. The head contains baffles for circuiting and is removable for easy access to coil tubes. Type “P” coils are cleanable from the supply end of the coil. Type “Q” coils are cleanable from the end opposite the supply. Type “K” coils are cleanable from both ends of the coil.



Installation

1. Carefully remove the coil from the shipping package to avoid damage to the finned surface area. Damaged fins can be straightened using an appropriate fin comb. If a mist eliminator was purchased, remove it before installation.
2. For coils with removable heads, check the torque on the nuts before installing. Refer to **Maintenance** on Page 6 for recommended torque values.
3. Heatcraft recommends cleaning the coil with a commercially available coil cleaner prior to installation. Refer to **Maintenance** on Page 6 for cleaning recommendations.
4. Check the coil hand designation to insure that it matches the system. Water and glycol coils are generally plumbed with the supply connection located on the bottom of the leaving air-side of the coil and the return connection at the top of the entering air-side of the coil (Figure 2 - Connection Diagram). This arrangement provides counter flow heat exchange and positive coil drainage. If a universal coil is supplied, cap off the two unused connections.
5. Standard coils must be mounted level to insure drainability. Refer to **Mounting** on page 2 for leveling requirements. Coils with intermediate headers and coils with removable box style headers can be pitched 1/8” per foot of coil finned length towards the coil’s header/connection end.
6. Proper clearance should be maintained between the coil and other structures such as the fan, filter racks, transition areas, etc..
7. Once installed, the coil should be pressurized to 100 psig with dry nitrogen or other suitable gas. The coil should be left pressurized for a minimum of 10 minutes. If the coil holds the pressure, the hook-up can be considered leak free. If the pressure drops by 5 psig or less re-pressurize the coil and wait another 10 minutes. If the pressure drops again, there is more than likely one or

more small leaks which should be located and repaired. Pressure losses greater than 5 psig would indicate a larger leak that should be isolated and repaired. If the coil itself is found to be leaking, contact your local Heatcraft coil representative. Unauthorized repair to the coil may void the coil's warranty (see Luvata's warranty policy on back cover).

8. All field brazing and welding should be performed using high quality materials and an inert gas purge (such as nitrogen) to reduce oxidation of the internal surface of the coil.
9. All field piping must be self supporting. System piping should be flexible enough to allow for thermal expansion and contraction of the coil.
10. General piping diagrams can be found in Figure 1 - Horizontal Airflow and Figure 3 - Vertical Airflow.
11. (If a mist eliminator was purchased) With the coil installed, place the mist eliminator into its brackets. Make sure the mesh is aligned with the coil face area (finned area).

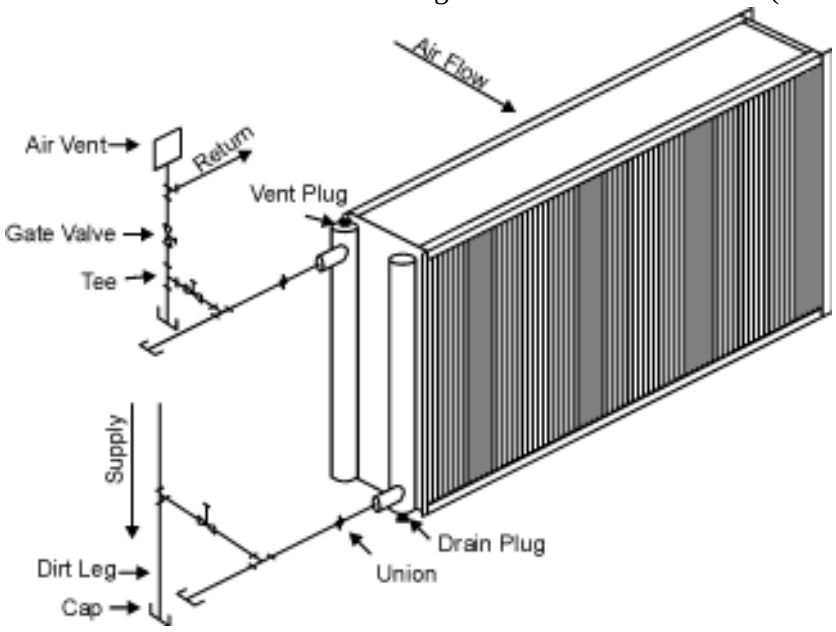


Figure 1 - Horizontal Airflow Diagram

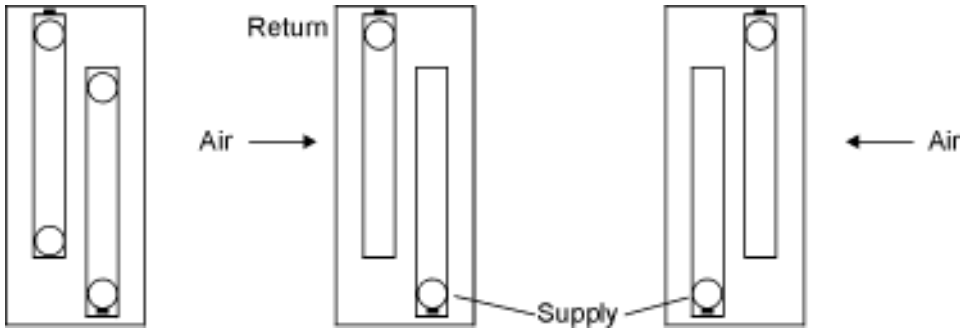


Figure 2 - Coil Diagram

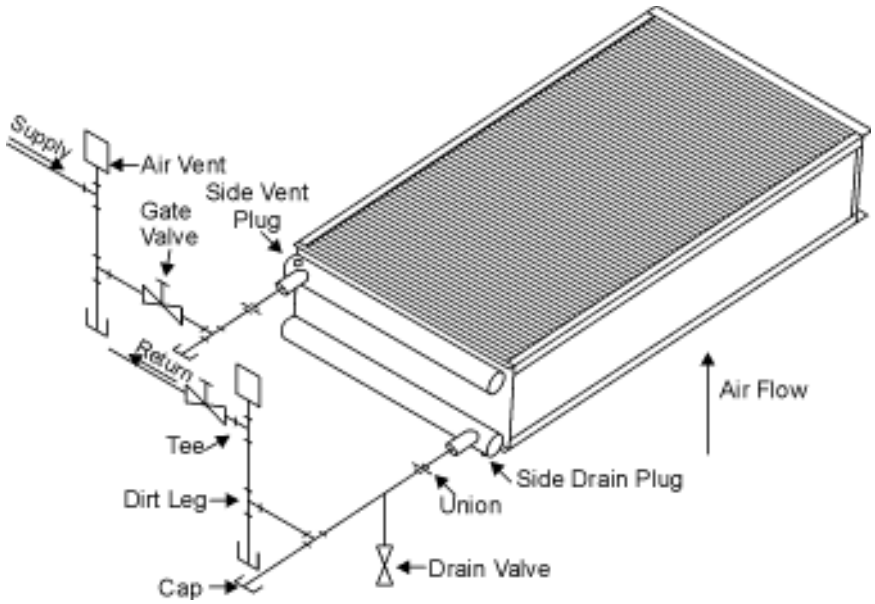


Figure 3 - Vertical Airflow Diagram

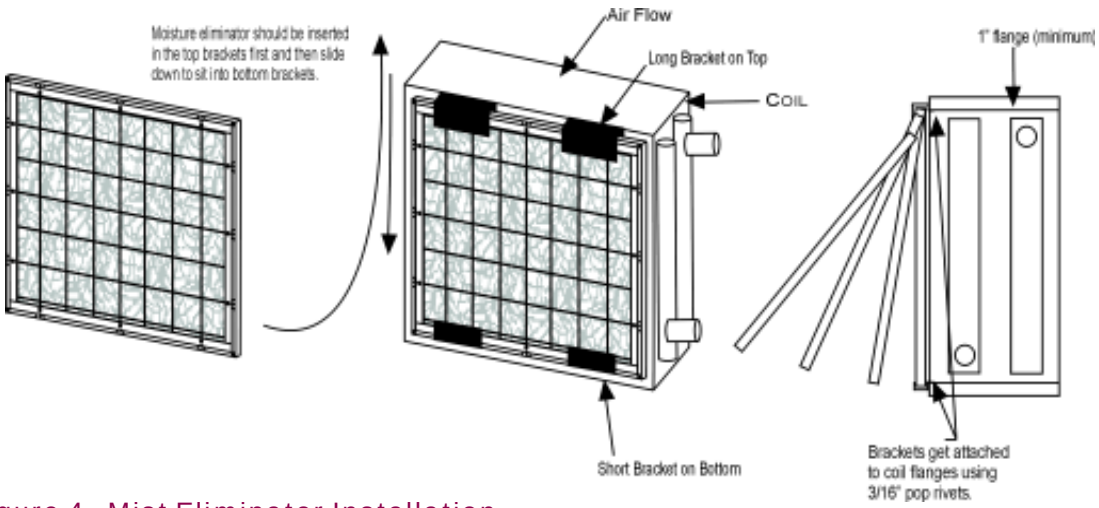


Figure 4 - Mist Eliminator Installation

Operation

Initial Start-Up

1. Open all air vents so that air is eliminated from within the coil circuitry and headers. Verify that all vents and drains are not obstructed and do discharge a stream of water.
2. Fill the coil with water then close all vents.
3. Perform an initial hydrostatic leak test of all brazed, threaded or flanged joints, valves and interconnecting piping. Recheck the coil level and correct if necessary. When the setup is found to be leak free, discharge and discard initial water charge. It is important that all grease, oil, flux and sealing compounds present from the installation be removed.

General

1. Proper air distribution is vital to coil performance. Air flow anywhere on the coil face should not vary by more than 20%.
2. The drain pan and associated piping (drain line and trap) should be installed so that there is no standing water in the drain pan and that no blow-through occurs.
3. Fluid and air velocities should be maintained within our recommended values.

Table 2a

Fluid Velocity	
Water	1 to 8 fps
Glycol	1 to 6 fps

Table 2b

Maintenance

General

1. Filters and mist eliminators should be inspected on a regular basis and changed as needed. Maintaining clean filters and mist eliminators is a cost effective way to help maintain maximum coil performance and service life.
2. Periodic inspection of the coil for signs of corrosion and/or leaks is recommended. Repair and replacement of the coil and the connecting piping, valves, etc., should be performed as needed by a qualified individual(s).
3. Should the coil surface need cleaning, caution should be exercised in selecting the cleaning solution as well as the cleaning equipment. Improper selection can result in damage to the coil and/or health hazards. Clean the coil from the leaving air-side so that foreign material will be washed out of the coil rather than pushed further in. Be sure to carefully read and follow the manufacturer's recommendations before using any cleaning fluid.
4. Maintain the circulated fluid free of sediment, corrosive products and biological contaminants. Periodic testing of the fluid followed by any necessary corrective measures along with maintaining adequate fluid velocities and proper filtering of the fluid will help to satisfy this goal.
5. If automatic air vents are not utilized, periodic venting of the coil is recommended to remove accumulated air. Caution should be exercised to avoid injury. High pressure and/or high temperature fluids can cause serious personal injury.
6. Heatcraft's cleanable coils with removable box headers should be cleaned using a suitable brush or its equivalent. Dislodged debris should be flushed from the coil and drain pan. Be sure that debris does not clog the drain. After the coil has been cleaned, the old gaskets should be discarded and replaced with new ones (contact your local Heatcraft coil representative for replacement gaskets). The box header should then be reinstalled. The recommended instal-

lation procedure is as follows.

a. Nuts and weld studs should be coated with thread lubricant.

b. Tighten all nuts per Figure 5 - Torque Pattern, to 35 ft-lb torque. After the initial torque has been applied retorque them to 50 ft-lb, again using the pattern shown in Figure 5. The permissible range of final torque values are as follows:

maximum torque:	53 ft-lb
design torque:	50 ft-lb
minimum torque:	47 ft-lb

c. Pressure test coils per the installation instructions.

d. After the coil has been leak tested and found to be free from leaks, let it sit for 24 hours. Retorque to 50 ft-lb per Figure 5 - Torque Pattern.

e. Refill the coil per the operation instructions.

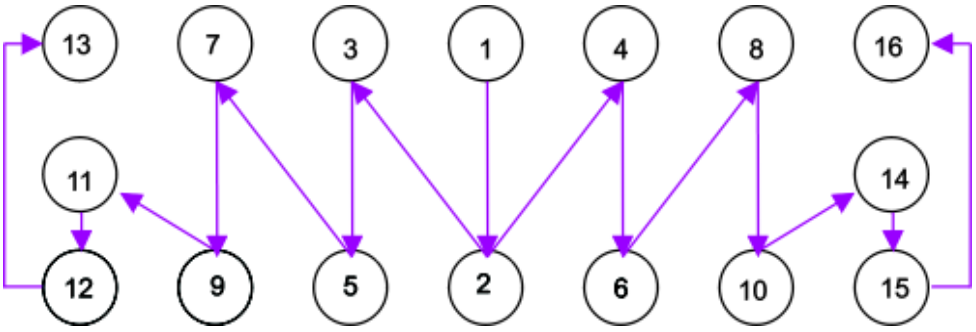


Figure 5 - Torque Pattern

Freeze Protection

During the winter, chilled water coils need to be protected against freezing. The two predominant protective measures are covered below.

Blowing-Out Coils

1. Isolate the coil from the rest of the system by closing the valves on both the supply and return lines (gate valves in Figure 1 - Horizontal Airflow and Figure 3 - Vertical Airflow).

2. Drain the coil by opening all drain valves and/or the drain plug. Remove the vent plug to aid the draining process.

3. Once the coil has been fully drained, the blower can be hooked-up. Caps installed in the piping on straight runs going to the supply and return connections are ideal points to hook-up the blower. The air vent and drain plug are not suitable locations for hooking-up the blower. *Caution should be exercised when installing the blower. The blower operator must take precautions to insure that water does not come into contact with any*

of the electrical components of the blower. Failure to do so may result in damage to the equipment and serious injury.

4. Close the vent or drain plug on the header which the blower is connected and open the drain valve or cap on the other header.
5. Operate the blower for 45 minutes and then check the coil to see if it is dry. A mirror placed in the discharge will become fogged if moisture is present. Repeat this procedure until the coil is dry.
6. Let the coil stand for several minutes then blow it out again. If water comes out, repeat the blowing operation.
7. Leave all plugs out and drains open until the threat of freezing has passed.

Flushing Coils

1. We recommend the use of inhibited glycol designed for HVAC applications for corrosion protection. The use of uninhibited glycol has produced formicary corrosion in copper tubing. The complete filling of water coils with an inhibited glycol solution for freeze protection can be expensive. In some instances, it is more cost effective to flush the coils with an appropriate concentration of inhibited glycol solution. Residual fluid can be left in the coil without the threat of freeze damage provided the correct concentration of inhibited glycol was used. The recovered fluid can then be used to flush other coils. Select an inhibited glycol solution that will protect the coil from the lowest possible temperatures that can occur at the particular coil's locality. The following tables have been provided for your convenience.

[1]Freeze points may vary from product to product.

2. Estimate the volume of the coil in gallons.

   For 5/8" tubes (1.5" face tube spacing)
   (finned height in inches)x(finned length in inches)x(# of rows)x 0.0011 = gallons
   For ½" tubes (1.25" face tube spacing)
   (finned height in inches)x(finned length in inches)x(# of rows)x 0.00083 = gallons
3. Isolate the coil from the rest of the system by closing the valves on both the supply and return lines (gate valves in Figure 1 - Horizontal Airflow and Figure 3 - Vertical Airflow).

4. Drain the coil by opening all drain valves and/or the drain plug. Remove the vent plug to aid the draining process.
5. Close the drain valve(s) and drain plug.
6. Connect the flushing system to the coil. A typical system is shown in Figure 6 - Flushing System Diagram.
7. With the throttling valve closed, start the pump and operate until the air is vented from the coil. Next, close the air vent.
8. Open the throttling valve about half-way and circulate the fluid through the coil for 15 minutes. Check the strength of the fluid. A hydrometer or test kit from the fluid manufacturer is suitable for this application.
9. Adjust the solution strength as needed and circulate the fluid for another 15 minutes.
10. Repeat steps 8 and 9 until the desired concentration is reached.
11. Shut the pump down and drain the inhibited glycol from the coil.
12. The recaptured fluid can be used to flush other coils.

Note: Be sure to follow the manufactures' recommendations before utilizing any glycol based anti-freeze solution. Additional fluid will be required for the pump, connected piping and fluid reservoir. Formulae are for estimation purposes only.

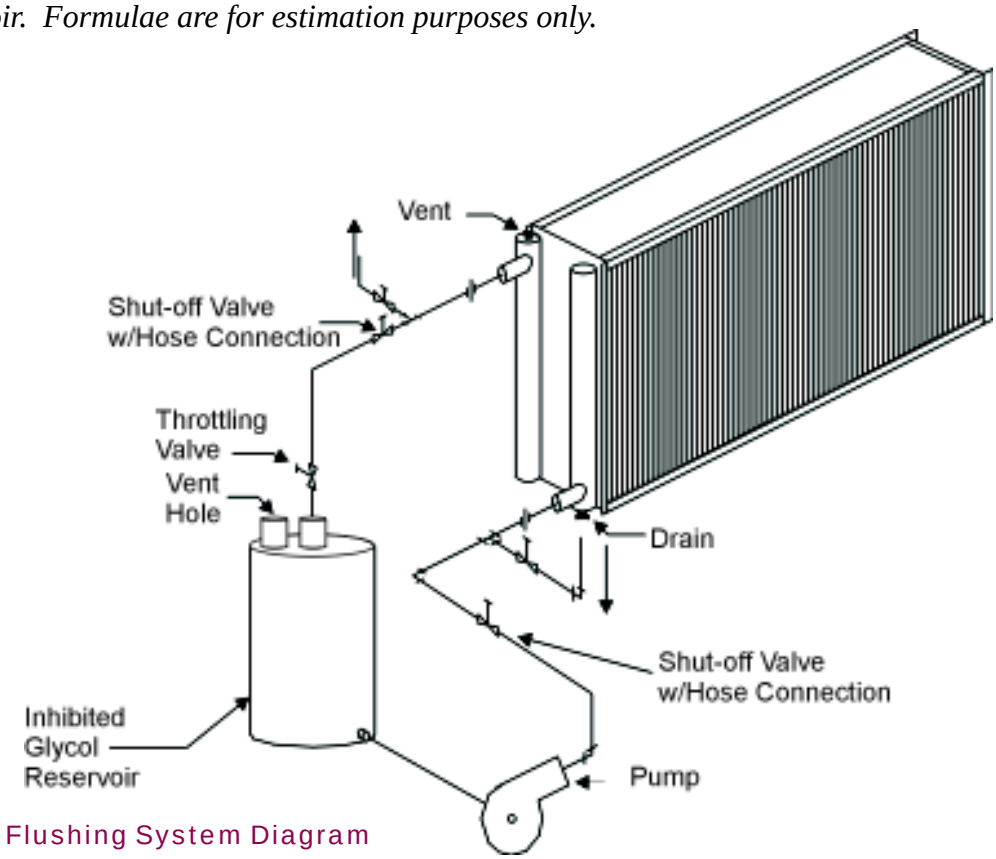


Figure 6 - Flushing System Diagram

COMMERCIAL PRODUCTS WARRANTY

Luvata Grenada LLC, hereinafter referred to as the “Company”, warrants that it will provide free suitable repair or replacement of coils in the event any coil of its manufacture used in the United States proves defective in material or workmanship within twelve (12) months from the date shipped by the Company.

THIS WARRANTY CONSTITUTES THE BUYER’S SOLE REMEDY. IT IS GIVEN IN LIEU OF ALL OTHER WARRANTIES. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT AND UNDER NO CIRCUMSTANCE SHALL THE COMPANY BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER THE THEORY BE BREACH OF THIS OR ANY OTHER WARRANTY, NEGLIGENCE, OR STRICT TORT.

This warranty extends only to the original purchaser. Of course, abuse, misuse, or alteration of the product in any manner voids the Company’s warranty obligation.

This warranty does not obligate the Company to pay any labor or service costs for removing or replacing parts, or any shipping charges.

No person (including any agent or salesman) has authority to expand the Company’s obligation beyond the terms of this express warranty, or to state that the performance of the coil is other than that published by Luvata Grenada LLC.

June 2006

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HEATCRAFT™

LUVATA

FLUID COILS

TABLE OF CONTENTS

NOMENCLATURE

5 W S 14 04 C 24.00 X 144

Tube OD:
3 = 3/8" or 0.375"
4 = 1/2" or 0.500"
5 = 5/8" or 0.625"

Coil Type:
W Standard water
M Splayed Headers
B Booster
K Cleanable both ends
P Cleanable supply end
Q Cleanable opp. supply end

Circuiting:
Q - Quarter
H - Half
L - Three Quarter
S - Single
M - One & one-half
D - Double
T - Two & one-half (5 & 10 rows)
T - Triple (3, 6, 9, & 12 rows)
B - Skip Tube

Booster:
S - 1 Circuit
D - 2 Circuits
B - Skip Tube

Fins Per Inch (4-18)

Rows Deep (1 to 12)

Fin Design:
A - Flat (AL, CU)
B - New Ripple (AL, CU)
C - Sine Wave (AL, CU)
D - Raised Lance (AL)
F - Flat (SS, CS)
G - New Ripple (SS, CS)
H - Sine Wave (AL, CU, SS, CS)

Fin Height

Finned Length

STANDARD FLUID COILS

HEATCRAFT's fluid coils are specifically designed for your particular application. Flexibility is built into our manufacturing processes, offering variations in fin type, fin density, circuitry arrangement, coil casing, and materials of construction. The fluid coils include two basic styles. The standard water, type "W", coils utilize a collection header for one and two row applications. This type also uses return bends for circuiting in coils with three rows or more. The splayed header, type "M", is only used for one or two row coils. Type "M" coils are always same end connections and use return bends for circuiting in lieu of a collection header. The term splayed means that the coil headers are offset outward from the coil tubes. Non-headered Booster, "B" type coils are also available for one and two row applications.

Figure 1 - Standard Coil Types

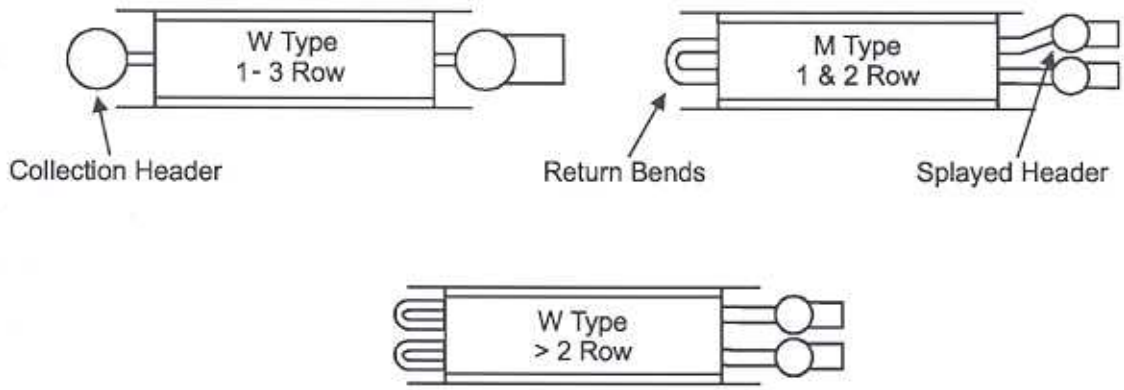
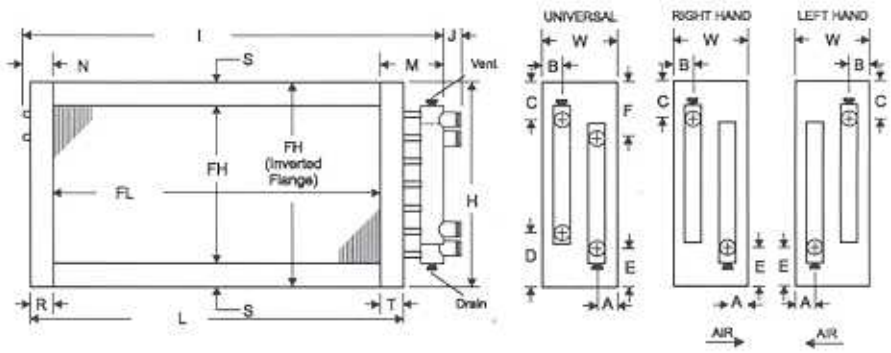


Table 1 - Standard Fluid Coil Dimensions

Case Type	Standard Dimensions						
	H	J	M	N	R	S	T
Flanged	FH + (Sx2)	3.00	Hdr. OD + 2.50	2.50	1.50	1.50	1.50
Inverted Flanges	<= 48" FL = FH + .189 > 48" FL = FH + .309				1.50	1.50	1.50
End Plates	FH or H				1.50	1.50	1.50

Figure 2 - Same End Connections

Model	Rows
MS	2
MH, MQ	1, 2
WQ, WH, WL	3, 4, 5, 6, 8, 10, 12
WS	4, 6, 8, 10, 12
WM	3*, 4, 5, 6, 8, 10, 12
WD	4*, 5*, 8, 12
WT	5*, 6*, 10, 12
*Left and Right Hand Only	



STANDARD FLUID COILS

Figure 3 - Opposite End Connections

Model	Rows
WS	3, 5
WD	6, 10
WT	9

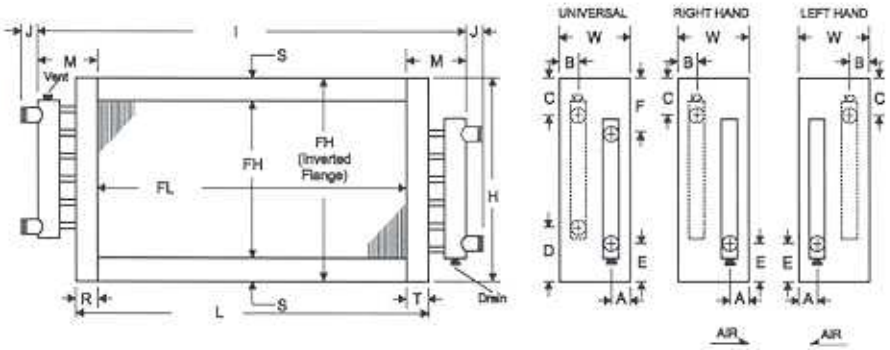


Figure 4 - Collection Header - Same End Connections

Model	Rows
WS	2
WB, WH, WQ	1, 2

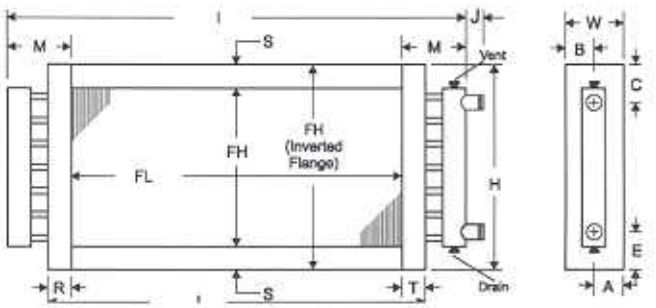
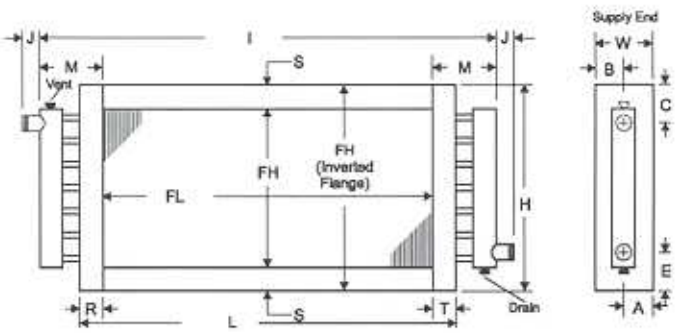


Figure 5 - Collection Header - Opposite End Connections

Model	Rows
WS	1
WD	2
WT	3



BOOSTER COILS

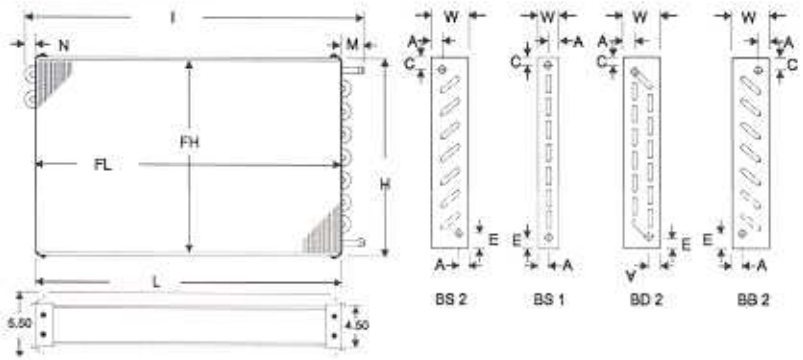
Table 2 - Standard Booster Dimensions

Case Type	Standard Dimensions for Booster Coils						
	H	J	M	N	R	S	T
Slip & Drive	FH + .312	3.00	*	2.00	N/A	N/A	N/A
Flanged	FH + (Sx2)				1.50	1.50	1.50
Inverted Flanges	<= 48" FL = FH + .189 > 48" FL = FH + .309						
End Plates	FH					N/A	

Table 2a - Booster "M" Dimensions

Coil Type	Connection	"M" Dimension
BB/BS	< 1"	3.00
BB/BS/BD	= 1"	4.12
BD	< 1"	3.50

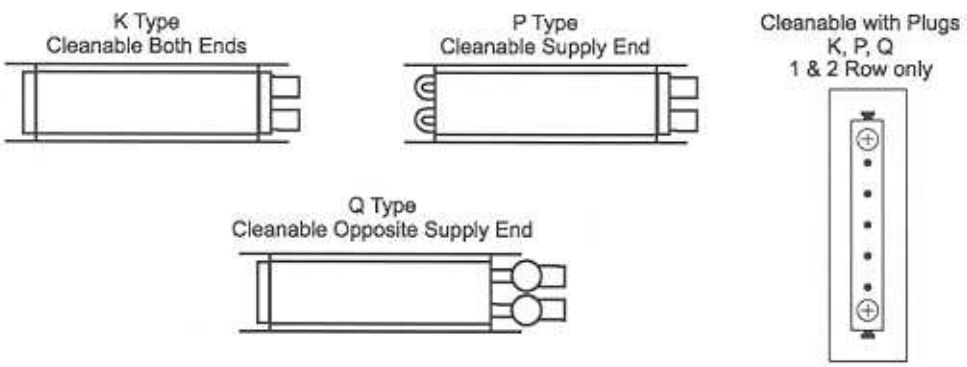
Figure 6 - Booster Coil - Slip & Drive shown



CLEANABLE COILS

HEATCRAFT also offers cleanable tube fluid coils, 5/8 coils only with a minimum .025 tube wall, for applications where mechanical cleaning of the coil tubes is required. Our cleanable coils utilize a removable steel header box in lieu of coil headers. This box contains baffles to provide coil circuitry and is removable for easy access to coil tubes. Model type "Q" is cleanable from the end opposite the supply connection. The mode type "P" is cleanable from the supply end. The model type "K" is cleanable from both ends. Our standard cleanable coils are only valid for operating pressures up to 100 psig. We, however, offer a high-pressure design, which can hold operating pressures up to 300 psig. This high-pressure design can only be utilized with our "K" type cleanable coils.

Figure 7 - Cleanable Coil Types



CLEANABLE COILS

Note: The standard type "W" coils can be made cleanable by installing cleanable plugs for each tube. This is an alternative to the steel head plate design and has a higher working pressure.

Table 3 - Standard Cleanable Coils with Plugs

Case Type	Standard Dimensions for Cleanable with Plugs								
	H	I (Same End)	I (Opp End)	J	L	M	R	S	T
Flanged	FH + (Sx2)	FL + (Mx2)	FL + (Mx2)	3.00	FL + R + T	Hdr. OD + 2.50	1.50	1.50	1.50
Inverted Flanges	<= 48" FL = FH + .189 > 48" FL = FH + .309								
End Plates	FH							N/A	

Figure 8 - Collection Header with Plugs- Same End Connections

Model	Rows
KS	2
KH, KQ	1, 2
QS	2
QH, QQ	1, 2
PS	2
PH, PQ	1, 2

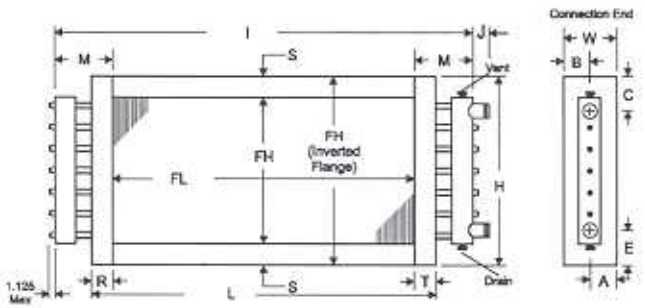
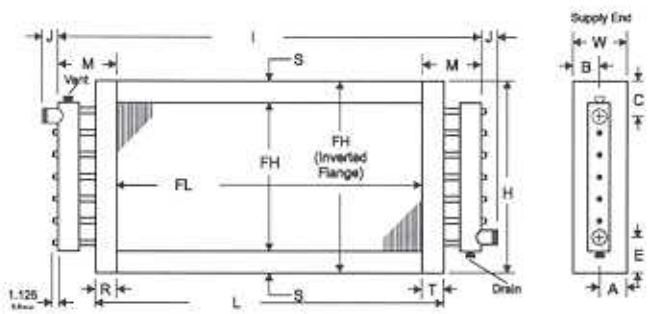


Figure 9 - Collection Header with Plugs - Opposite End Connections

Model	Rows
KS, PS, QS	1
KD, PD, QD	2



Model "K" coils have plugs on both ends (as shown above)

Model "P" coils have plugs on the supply end only

Model "Q" coils have plugs on the return end only

Table 4 - Standard Cleanable Coils with Header Plates

Case Type	Standard Dimensions for Cleanable Coil with Header Plates								
	H	I (Same End)	I (Opp End)	J	L	N	R	S	T
Flanged	FH + (Sx2)	FL + N + M	FL + (Mx2)	3.00	FL + R(T) + T	2.50	1.50	1.50	1.50

Table 5 - Connection "M"

Connection	"M" Dimension
2.00	5.00
2.50	5.25
3.00	5.62

Figure 10 - Cleanable Both Ends - Same End Connections - Single & Double Serp

Model	Rows
KS	4, 6, 8, 10, 12
KD	4, 8, 12
KT	6, 12

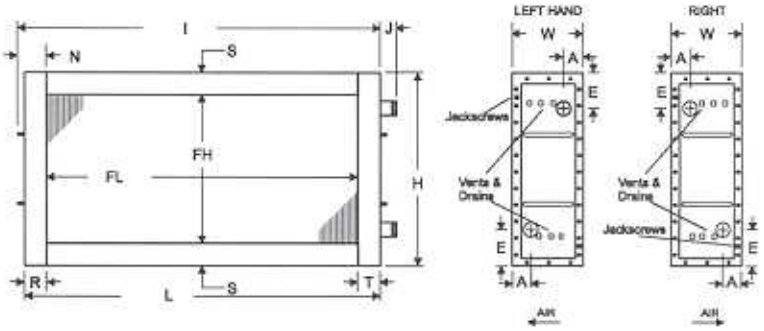
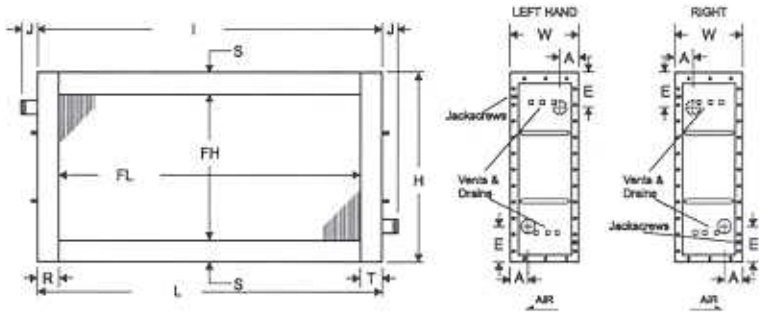


Figure 11 - Cleanable Both Ends - Opposite End Connections

Model	Rows
KD	6, 10



CLEANABLE COILS

Figure 12 - Cleanable Both Ends - Same End Connection - Half Serp

Model	Rows
KH	4, 6, 8, 10, 12

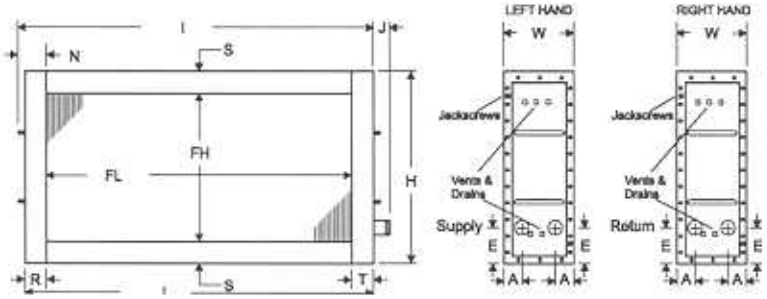


Figure 13 - Cleanable Opposite Supply End - Same End Connections - Single & Double Serp

Model	Rows
QD	4, 8, 12
QS	4, 6, 8, 10, 12
QT	6, 12

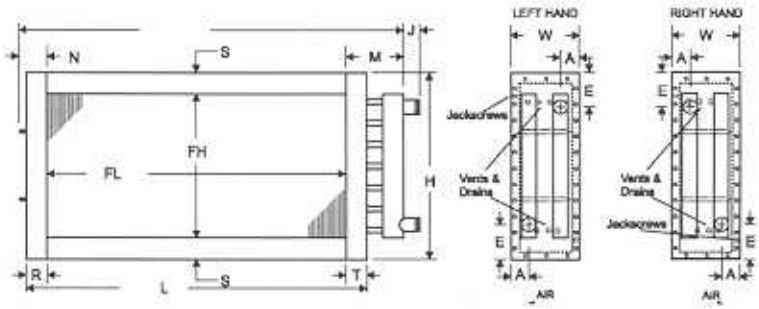


Figure 14 - Cleanable Opposite Supply End - Opposite End Connections

Model	Rows
QD	6, 10

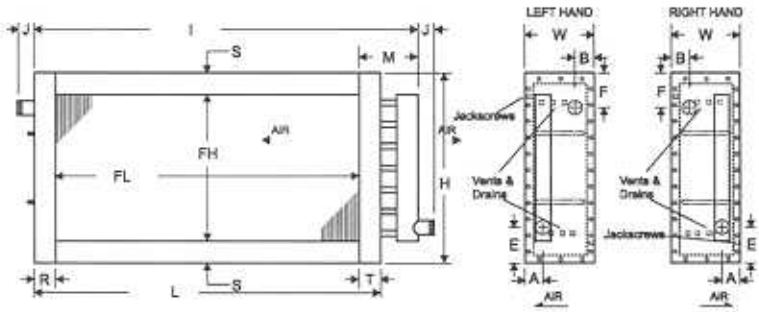


Figure 15 - Cleanable Opposite Supply End - Same End Connection - Half Serp

Model	Rows
QH	4, 6, 8, 10, 12

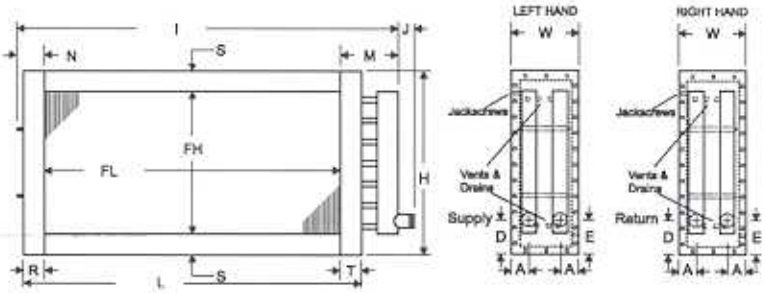


Figure 16 - Cleanable Supply End - Same End Connections

Model	Rows
PS	4, 6, 8, 10, 12
PD	4, 8, 12
PT	6, 12

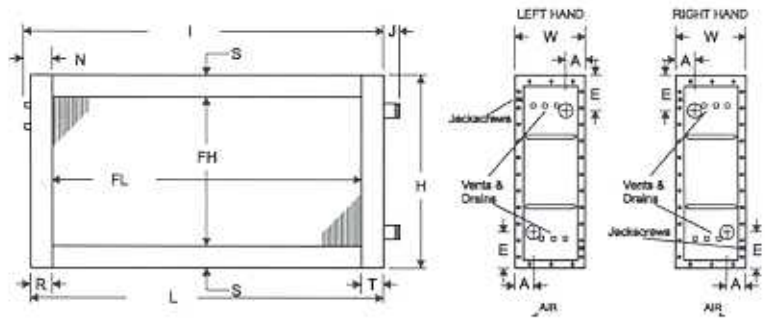
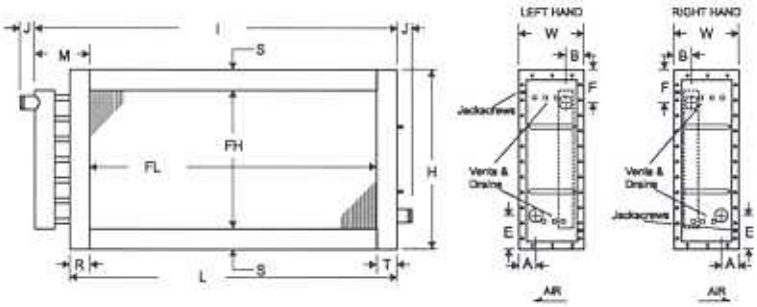


Figure 17 - Cleanable Supply End - Opposite End Connections

Model	Rows
PD	6, 10



CONNECTIONS

Connections are constructed of carbon steel, red brass, copper sweat or stainless steel material. All connections are male pipe thread (MPT), unless specified differently. Female pipe thread, grooved and butt-welded connections are also available. Supply connections are located at the bottom of the coil and the return connections are located at the top of the coil, unless stated otherwise.

Universal connection coils have 2 supply connections and 2 return connections. The coil is both left and right hand. This option is used when the coil hand is not available or if the coil is to be used as a backup for quick replacement of either a right or left hand coil. Using universal connections can cut inventory by providing the flexibility of one coil for either hand connections. Upon installation the extra connections are capped since they are not needed.

Table 6 - Connection Material

Connection Material
Red Brass ASTM B43 Std Wt
Stainless Steel 304L or 316L ASTM A312 Sch 40 or Sch 80
Carbon Steel A53A Sch 40 or Sch 80

Figure 18 - Connection Location

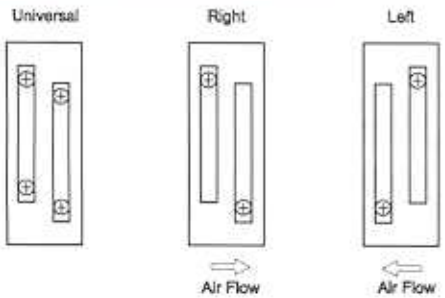


Table 7 - Connection Size vs. GPM

Conn Size	Max GPM	Conn Size	Max GPM
.500	6.0	2.00	60.0
.750	6.0	2.50	125.0
1.00	12.0	3.00	180.0
1.25	20.0	3.50	260.0
1.50	35.0	4.00	300.0

Table 8 - Tube & Header Material

Coil Type	Tube Dia	Tube Matl	Tube Thickness	Header End Cap	Max Std Operating Limits	
					PSIG	Temp
3W, 3M, 3B	.375	CU	.013, .016, .020, .025, .030	CU	250	300°F
4W, 4M, 4B	.500	CU	.016, .022, .030	CU	250	300°F
5W, 5M, 5B	.625	CU	.020, .025, .035, .049	CU	250	300°F
		CN	.020, .035, .049	Monel		
		AB	.049			
		SS	.035, .049, .065	SS	Consult Factory	Consult Factory
		CS	.049, .065	CS		
5K, 5P, 5Q	.625	CU	.025, .035, .049	CU	250	300°F
		CN	.035, .049	Monel	100	150°F
		AB	.049			
		SS	.035, .049, .065	SS		
		CS	.035, .049, .065	CS		

HEADERS

Material	Material Type	ASTM Rating
Copper	UNS 12200 Seamless Copper	ASTM B75 & ASTM B251
Cupronickel	Seamless 90/10 Cupronickel Alloy C70600	ASTM B111
Stainless Steel	Stainless Steel 304L & 316L, Sch-5 or Sch-10	ASTM-A312
Carbon Steel	Carbon Steel Sch-10	ASTM-A135A
Carbon Steel	Carbon Steel Sch-40	ASTM A53A

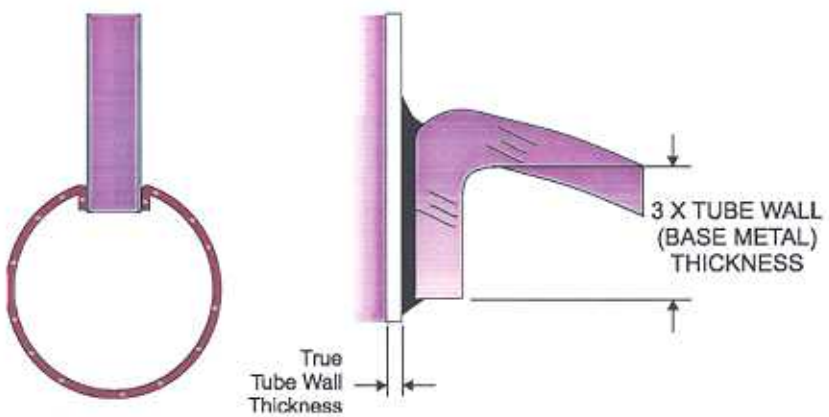
END CAPS

End caps will 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.

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. When possible, intruded tube holes in the header allow an extra landed brazing surface for increased strength and durability. The landed the surface area is three times the core tube thickness to provide enhanced header-to-tube joint integrity. All core tubes are evenly extend within the inside diameter of the header no more than 0.12 inch.

Figure 19 - Brazed Joint



COIL CASE

Casings and endplates are 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 stacking of the coils. All sheet metal brakes shall be bent to 90 degrees +/- 2 degrees otherwise. Coils shall be constructed with intermediate tube support sheets fabricated from a heavy gauge sheet stock of the same material as the case, when possible.

Figure 20 - Coil Case

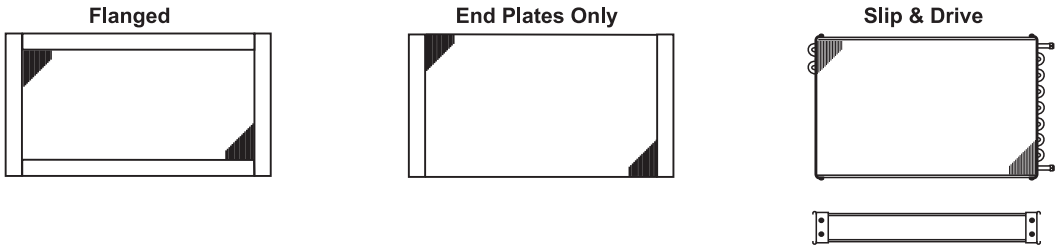


Table 9 - Coil Case Material

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 (.125 only)	X	X	X
Stainless Steel 304L (or) 316L, 2B-Finish, ASTM A-240	X	X	*X
Stainless Steel 201L	X	X	

*Not available in pierce and flare header plates

TUBE SUPPORTS
Quantity

Table 10 - Tube Supports

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

TUBING

Tubing and return bends are be constructed from seamless copper, cupro-nickel, admiralty brass, stainless steel or carbon steel tubing. Copper tube temper are light annealed with a maximum grain size of 0.040 mm and a maximum hardness of Rockwell 65 on the 15T scale. Tubes are mechanically expanded to form an interference fit with the fin collars. Tubes will have a nominal thickness of 0.020 inch unless otherwise specified.

Table 11 - Tubing Material

Material	Tube Thickness (in.)				
	.020	.025	.035	.049	.065
Copper UNS #C12200, ASTM B-75, B-68, B-251	X	X	X	X	X
Cupro-nickel UNS #C70600, 90/10, ASTM B-111	X		X	X	
Admiralty Brass UNS #44400, ASTM B-111, Type-B				X	
Stainless Steel 304L (or) 316L, ASTM A-249			X	X	X
Carbon Steel W&D ASTM 214			X	X	X

FINS

Coils are 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 carbon 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.

Table 12 - Fin Material

Material	Fin Thickness (in.)			
	.0060	.0075	.0095	.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	

*5/8" A and B surface only

Table 13 - Fin Size

Tube Dia	Fin Matl	Fin Size	FPI	Fin Style	Fin Thickness			
					.0060	.0075	.0095	.0160
.375	AL	1.00 x 0.866	6-24	A, B, C, D	x	x		
		1.25 x 1.083	6-16	H	x	x	x	
	CU	1.00 x 0.866	6-24	A, B, C, D	x	x		
		1.25 x 1.083	6-16	H	x	x		
.500	AL, CU	1.25 x 1.083	6-20	A, B, C	x	x	x	x
.500	AL, CU	1.50 x 1.299	4-5	A, B			x	x
				C			x	
			6-14	A, B	x	x	x	x
				C	x	x	x	
.625	AL, CU	1.50 x 1.299	4-5	A, B			x	x
				C			x	
			6-14	A, B	x	x	x	x
				C	x	x	x	
	SS, CS	1.50 x 1.50	4-5	F, G, H			x	
			6-14			x	x	

FLUID CONSTRUCTION

COIL OPTIONS

VENT AND DRAIN CONNECTIONS come standard on all fluid coils except booster type coils, which do not have headers. The standard vent and drain connections are 1/2" female pipe thread with a hex head mpt plug. 1/2" male pipe connection is also available. The standard location for the vent and drain is on the end of the supply and return headers. For horizontal air flow with the headers standing vertically, the vent is located on the top of the return header in the end cap. The drain connection is located on the bottom of the supply header in the end cap. Note that one and two row heating coils with a collection header, type "W", will have both connections on one header for same end connection coils.

Heatcraft can also place the vent and drain connections on the face of the header facing parallel to the coil tubes; these connections can be extended to the same length as the supply and return connections for easy access. Another option is to locate the vent and drain connections on the side of the coil headers facing outward, with the drain connection facing in the direction of the air flow, and the vent connection facing upstream from airflow. This is usually done for verticall airflow applications.

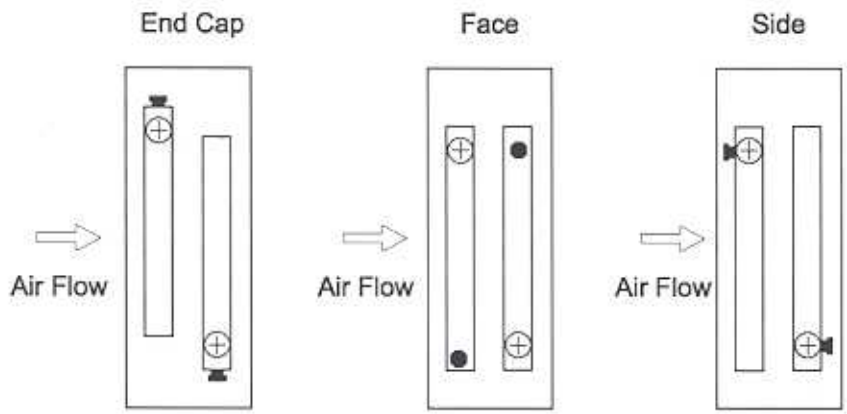


Figure 21 - Vent and Drain

BRASS TURBOSPIRALS can be installed within the coil tubes. These turbospirals increase the amount of turbulence in the fluid flow and thus increase the rate of heat transfer. This allows for an increase in capacity without affecting the external coil dimensions or increasing air pressure drop. Note that the increase in turbulence will also increase the fluid pressure drop.

CLEANABLE PLUGS can be installed on standard water coils to allow for mechanical cleaning of the internal surface of the coil tubes. The plugs can be installed on one end or both ends as needed. These brass plugs offer a more economical option to attain cleanability with out the cost of a the removable steel baffle plate design, (Heatcraft type 'P', 'Q' or 'K'). The cleanable plugs generally require more labor to clean than the steel header box design.

SPECIAL COATINGS such as baked phenolic coating can be applied to the entire external surface of coil after fabrication to provide corrosion resistance in harsh environments. Contact factory for application assistance or further information on this and other available special coil coatings, as well as lead-time.

SCHEDULE 40 PIPE DIMENSIONS

Table 14 - Schedule 40

Pipe Size (in.)	External Dia. (in.)	Internal Dia. (in.)	Internal Area in²	Volume ft³/ft	Weight lbs/ft	Threads per inch
.250	5.40	.364	.104	.00072	.424	18
.375	.675	4.93	.191	.00133	.564	18
.500	8.40	.622	.304	.00211	.850	14
.750	1.050	.824	.533	.00370	1.130	14
1.00	1.315	1.049	.864	.00600	1.678	11.50
1.50	1.900	1.610	2.038	.01414	2.717	11.50
2.00	2.375	2.067	3.355	.02330	3.652	11.50
2.50	2.875	2.469	4.788	.03250	5.793	8
3.00	3.500	3.068	7.393	.05134	7.575	8
3.50	4.000	3.548	9.886	.06866	9.109	8
4.00	4.500	4.026	12.730	.8840	10.790	8

Note: Pipe threads listed are N.P.T.

SCHEDULE 80 PIPE DIMENSIONS

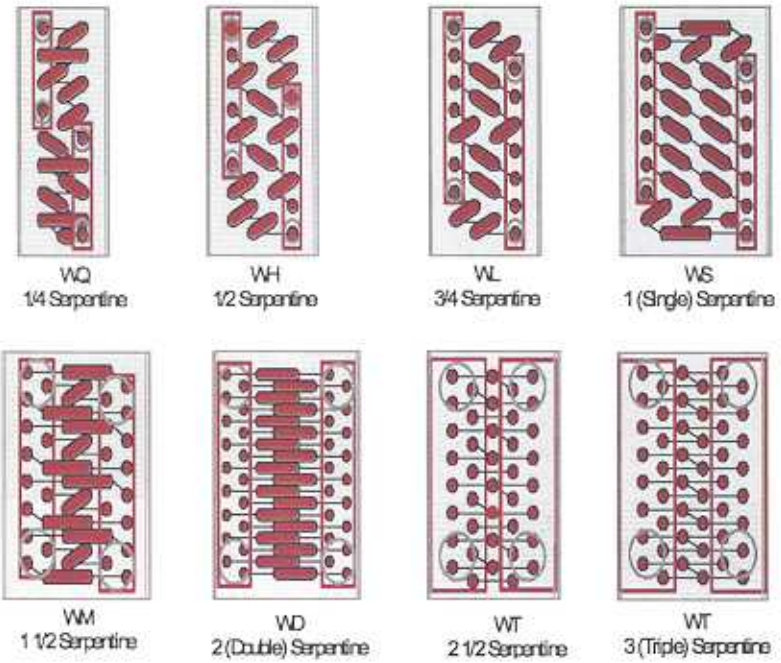
Pipe Size (in.)	External Dia. (in.)	Internal Dia. (in.)	Internal Area in²	Volume ft³/ft	Weight lbs/ft	Threads per inch
.250	5.40	.302	.072	.00050	.535	18
.375	.675	4.23	.141	.00098	.738	18
.500	8.40	.546	.234	.00163	1.000	14
.750	1.050	.742	.433	.00300	1.470	14
1.00	1.315	.957	.719	.00500	2.170	11.50
1.50	1.900	1.500	1.767	.01227	3.650	11.50
2.00	2.375	1.939	2.953	.02051	5.020	11.50
2.50	2.875	2.323	4.238	.02943	7.660	8
3.00	3.500	2.900	6.605	.04587	10.300	8
3.50	4.000	3.364	8.888	.06172	12.500	8
4.00	4.500	3.826	11.497	.07980	14.900	8

Note: Pipe threads listed are N.P.T.

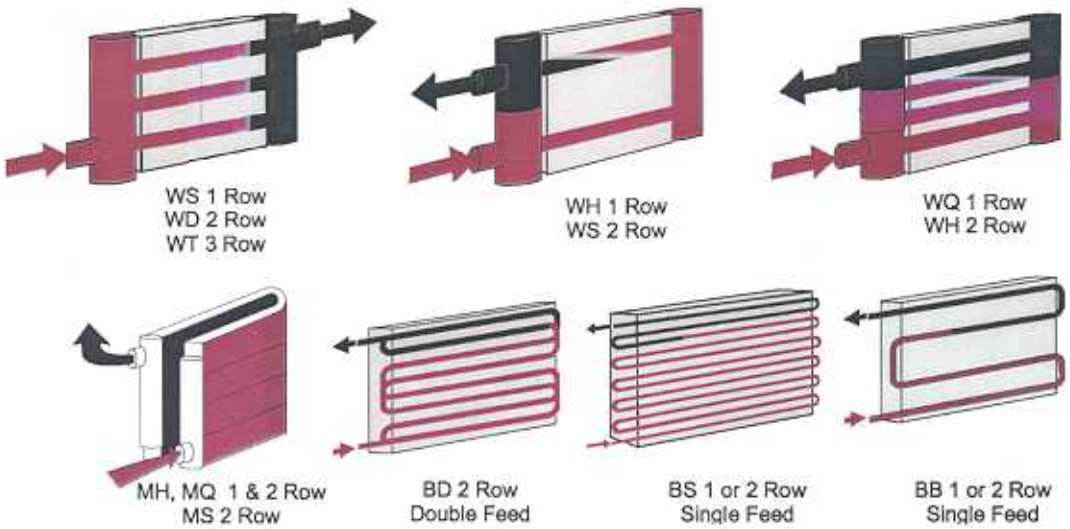
Table 15 - Schedule 80

ENGINEERING

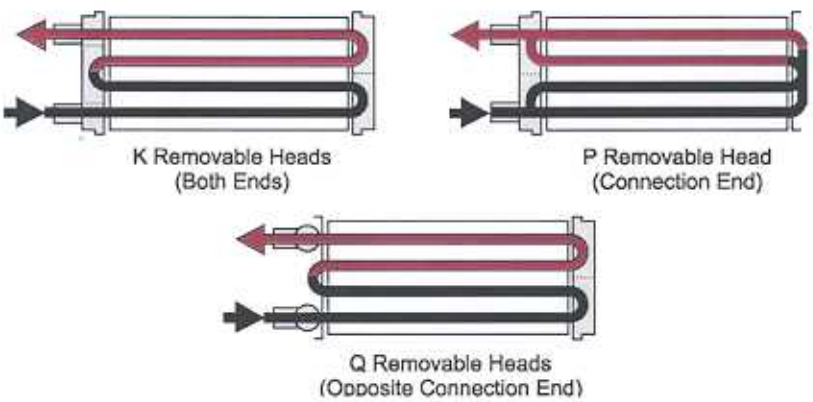
COOLING COILS
Circuiting/Serpentine



HEATING COILS



CLEANABLE COILS



PSYCHROMETRIC CHART

The psychrometric chart provides a graphical representation of the thermodynamic properties of moist air. The chart correlates various properties, which are interrelated. The properties shown on the chart are the following: dry bulb, wet bulb, relative humidity, enthalpy, humidity ratio, dew point and specific volume. If you are given any two of these properties along with barometric pressure it is possible to determine the other properties using the chart once your conditions are correctly plotted.

Example: Given a dry bulb temperature of 80°F, 50% relative humidity at standard atmospheric pressure determine the wet bulb, enthalpy, humidity ratio, and dew point using the psychrometric chart and a straight edged ruler.

The correct answers are wet bulb= 66.9°F, enthalpy= 31.9 Btu/lb. dry air, humidity ratio = .011, dew point = 59.5°F.

By plotting the beginning and ending conditions of a moist air system you can visually verify the changes, which are occurring between these two points. Draw a straight line between the initial and the ending positions on the chart. Clearly mark which point is beginning and which is ending. Moving from the initial to final condition will give a direction of movement. This direction identifies what type of process has occurred. See the outline of the psychrometric chart below.

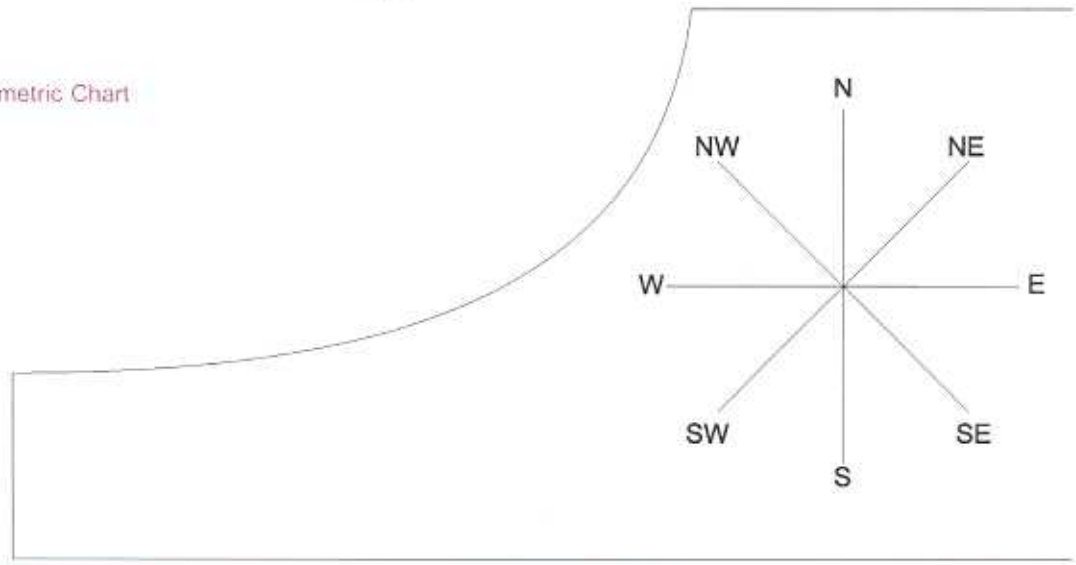


Figure 22 - Psychrometric Chart

Movement	Process Occurring	Typical Application
East	Sensible Heating Only*	Comfort Heating
Northeast	Heating with Humidification	Comfort Heating & Increasing Moisture
North	Humidification Only	Only Increasing Moisture
Northwest	Evaporative Cooling	Cooling in Very Low Humidity Areas
West	Sensible Cooling Only	Cooling without Moisture Removal
Southwest	Cooling with Dehumidification*	Comfort Cooling & Moisture Removal
South	Demidification Only	Moisture Removal

* Most common processes which occur for comfort heating and cooling.

Table 16 - Regional Application

COMBINING TWO ADIABATIC, EQUAL PRESSURE AIR STREAMS

This is a common problem in air duct systems. This situation occurs when outside air is being introduced into the return air ductwork. Here you have two different entering air-conditions each with different volumes coming together to be conditioned. Using a graphical representation on the psychrometric chart can solve this problem. This process assumes that both airstreams are at approximately the same pressure. Below is an example of how to solve this problem.

Example: Given two airstreams

1. 400 CFM of air at 95/78°F (Dry bulb/Wet bulb)
2. 3600 CFM of air at 80/67°F (Dry bulb/Wet bulb)

Find the resulting combined air stream conditions

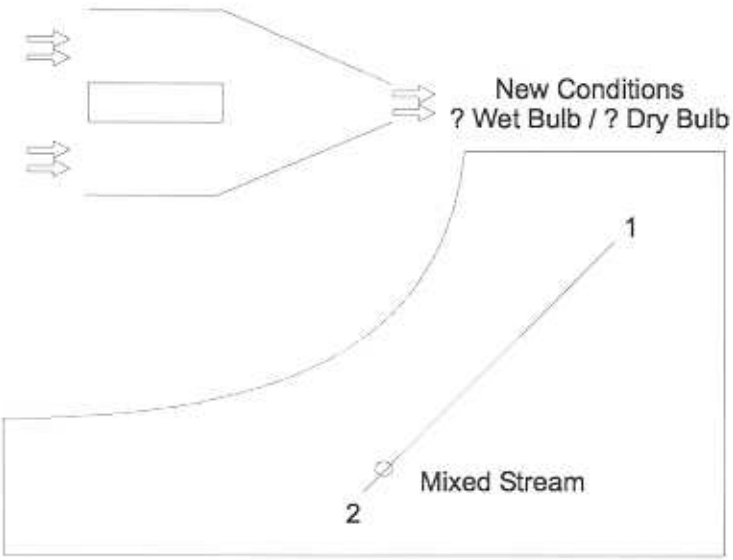


Figure 23 - Air Streams

Step 1: Plot both conditions on the psychrometric chart and identify the points.

Step 2: Draw a line between the points. The final mixed air stream's state lies on this line.

Step 3: Calculate the volumetric ratio of the dry air masses. To do this add the airflows together, and then divide the larger airflow by this total.
3600 CFM + 400 CFM = 4000 CFM Total
3600 CFM/4000 CFM = .90

Step 4: With a ruler measure the straight-line length between the two points. Multiply this length by the volumetric ratio to get the distance you must travel along this line from the smaller airflow point.

The resulting mixed air stream is 4000 CFM at approx. 82/68°F (dry bulb/wet bulb).

Note: The resulting point plotted on the connecting line will be closest to the point representing the larger of the two airflows. If the airflow were equal the center point on the line would determine the resulting combined entering air conditions.

TOTAL HEAT (ENTHALPY)

HEAT CONTENT (BTU) OF 1 LB. OF DRY AIR SATURATED WITH WATER VAPOR†

(Standard atmospheric pressure 29.921" HG)

WET BULB °F*	TENTHS OF DEGREES									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
35	13.01	13.05	13.09	13.14	13.18	13.22	13.27	13.31	13.35	13.39
36	13.44	13.48	13.52	13.57	13.61	13.66	13.70	13.74	13.79	13.83
37	13.87	13.92	13.96	14.01	14.05	14.10	14.14	14.19	14.23	14.27
38	14.32	14.36	14.41	14.45	14.50	14.54	14.59	14.63	14.68	14.73
39	14.77	14.82	14.86	14.91	14.95	15.00	15.05	15.09	15.14	15.18
40	15.23	15.28	15.32	15.37	15.42	15.46	15.51	15.56	15.60	15.65
41	15.70	15.74	15.79	15.84	15.89	15.93	15.98	16.03	16.08	16.12
42	16.17	16.22	16.27	16.32	16.37	16.41	16.46	16.51	16.56	16.61
43	16.66	16.71	16.75	16.80	16.85	16.90	16.95	17.00	17.05	17.10
44	17.15	17.20	17.25	17.30	17.35	17.40	17.45	17.50	17.55	17.60
45	17.65	17.70	17.75	17.80	17.85	17.91	17.96	18.01	18.06	18.11
46	18.16	18.21	18.26	18.32	18.37	18.42	18.47	18.52	18.58	18.63
47	18.68	18.73	18.79	18.84	18.89	18.95	19.00	19.05	19.10	19.16
48	19.21	19.26	19.32	19.37	19.43	19.48	19.53	19.59	19.64	19.70
49	19.75	19.81	19.86	19.92	19.97	20.03	20.08	20.14	20.19	20.25
50	20.30	20.36	20.41	20.47	20.52	20.58	20.64	20.69	20.75	20.81
51	20.86	20.92	20.98	21.03	21.09	21.15	21.21	21.26	21.32	21.38
52	21.44	21.49	21.55	21.61	21.67	21.73	21.79	21.84	21.90	21.96
53	22.02	22.08	22.14	22.20	22.26	22.32	22.38	22.44	22.50	22.56
54	22.61	22.68	22.74	22.80	22.86	22.92	22.98	23.04	23.10	23.16
55	23.22	23.28	23.34	23.41	23.47	23.53	23.59	23.65	23.72	23.78
56	23.84	23.90	23.97	24.03	24.10	24.16	24.22	24.29	24.35	24.42
57	24.48	24.54	24.61	24.67	24.74	24.80	24.86	24.93	24.99	25.06
58	25.12	25.19	25.25	25.32	25.38	25.45	25.52	25.58	25.65	25.71
59	25.78	25.85	25.92	25.98	26.05	26.12	26.19	26.26	26.32	26.39
60	26.46	26.53	26.60	26.67	26.74	26.80	26.87	26.94	27.01	27.08
61	27.15	27.22	27.29	27.36	27.43	27.50	27.57	27.64	27.71	27.78
62	27.85	27.92	27.99	28.07	28.14	28.21	28.28	28.35	28.43	28.50
63	28.57	28.64	28.72	28.79	28.87	28.94	29.01	29.09	29.16	29.24
64	29.31	29.38	29.46	29.53	29.61	29.68	29.76	29.83	29.91	29.98
65	30.06	30.16	30.21	30.29	30.37	30.44	30.52	30.60	30.68	30.75
66	30.83	30.91	30.99	31.07	31.15	31.22	31.30	31.38	31.46	31.54
67	31.62	31.70	31.78	31.86	31.94	32.02	32.10	32.18	32.26	32.34
68	32.42	32.50	32.59	32.67	32.75	32.83	32.92	33.00	33.08	33.17
69	33.25	33.33	33.42	33.50	33.59	33.67	33.75	33.84	33.92	34.00
70	34.09	34.18	34.26	34.35	34.43	34.52	34.61	34.69	34.79	34.86
71	34.95	35.04	35.13	35.21	35.30	35.39	35.48	35.57	35.65	35.74
72	35.83	35.92	36.01	36.10	26.19	36.28	36.38	36.47	36.56	36.65
73	36.74	36.83	36.92	37.02	37.11	37.20	37.29	37.38	37.48	37.57
74	37.66	37.75	37.85	37.94	38.04	38.13	38.23	38.32	38.42	38.51
75	38.61	38.71	38.80	38.90	39.00	39.09	39.19	39.28	39.38	39.47
76	39.57	39.67	39.77	39.87	39.98	40.07	40.17	40.27	40.37	40.47
77	40.57	40.67	40.77	40.87	40.97	41.07	41.18	41.28	41.38	41.48
78	41.58	41.68	41.79	41.89	42.00	42.10	42.20	42.31	42.41	42.52
79	42.62	42.73	42.83	42.94	43.05	43.15	43.26	43.37	43.48	43.58
80	43.69	43.80	43.91	44.02	44.13	44.23	44.34	44.45	44.56	44.67
81	44.78	44.89	45.00	45.12	45.23	45.34	45.45	45.56	45.68	45.79
82	45.90	46.01	46.13	46.24	46.36	36.47	46.58	46.70	46.81	46.93
83	47.04	47.16	47.28	47.39	47.51	47.63	47.75	47.87	47.98	48.10
84	48.22	48.34	48.46	48.58	48.70	48.82	48.95	49.07	49.19	49.31
85	49.43	49.55	49.68	49.80	49.92	50.04	40.17	50.29	50.41	50.54

*Use wet bulb temperature only in determining total heat.

†Compiled from data in ASHRAE Handbook of Fundamentals 1981.

Table 17 - BTU

GENERAL FORMULAS

TOTAL BTUH (Air Cooling)

Total BTUH = 4.5 x SCFM x (Total Heat Ent. Air - Total Heat Lvg. Air)

Where 4.5 = Density Std. Air x Min./Hr.

Density std. air = .075 lbs./cu. ft.

Min./hr. = 60

TOTAL BTUH (Air Heating)

Total BTUH = 1.08 x SCFM x (Lev. Air DB - Ent. Air DB)

Where 1.08 = (Specific heat) x (Minutes/ Hr.) x Density Std. Air

Specific heat = .24 btu/lb.F

Min./hr. = 60

Density std. air = .075 Lbs./cu. ft.

TOTAL BTUH(Water Side)

Total BTUH = 500 x GPM x (Lvg.Water Temp - Ent. Water Temp)

Where 500 = Lbs./Gal. x Min./Hr. x Specific heat water

Lbs./gal. = 8.33

Min./hr.= 60

Specific heat = 1 btu/lb.F

SENSIBLE BTUH (Air Cooling)

Sensible BTUH = 1.08 x SCFM x (Ent. Air DB - Lvg. Air DB)

Where 1.08 = (Specific heat of air) x (Minutes/Hr.) x Density Std. Air

Specific heat = .24 btu/lb.F

Min./hr. = 60

Density std. air = .075 Lbs./cu. ft.

Standard Conditions:

Temperature = 70°F

Pressure = 14.69 psi

Density = .075 lb/ft³

SENSIBLE TOTAL RATIO

S/T Ratio = Sensible BTUH ÷ Total BTUH

LEAVING AIR TEMPERATURE (heating)

Lvg Air Temp. = Ent. Air Temp. + (Sensible BTUH ÷ (1.08 x SCFM))

LEAVING AIR TEMPERATURE (cooling)

Lvg Air Temp. = Ent. Air Temp. - (Sensible BTUH ÷ (1.08 x SCFM))

FACE AREA

FA (Sq. Ft.) = (Fin Height x Finned Length) ÷ 144

FACE VELOCITY (FPM)

FPM = SCFM ÷ Face Area (sq. ft.)

MBH PER SQUARE FOOT OF FACE AREA

MBH/Sq. Ft. = Total BTUH ÷ (Face Area (Sq. Ft.) x 1000)

WATER VELOCITY

FPS = (.0022 x GPM) / (CS x # of circuits)

CS = .785 x $(D-2t)^2$

(where D = tube outside diameter

t = tube thickness)

Number of Circuits

for: 5A, 5B, 5C, 4H (FH ÷ 1.5) x Serpentine

for: 4A, 4B, 4C (FH ÷ 1.25) x Serpentine

M.A.R.C. (Modular Auxiliary Removable Coil)

Picture 1 - M.A.R.C. Unit

- Replaces existing coil section
- Removable coil through access door
- Galvanized or stainless steel casing
- Modular unitary construction
- Insulated (single wall)
- Stainless steel drain pan
- Auxiliary/supplemental heating or cooling
- Add heating or cooling to make-up air unit
- Replaces existing coil section
- External (vertical) filter rack option

HIGH-PRESSURE CLEANABLE COIL

Picture 2 - High-Pressure Cleanable Coil

- For high-pressure fluid applications up to 300 psig operating pressure
- Removable heads on both ends allow for internal tube cleaning without clogging the ends of the coil
- Tube materials: using a combination of copper, cupro-nickel, stainless steel or carbon steel tubes
- Fin material made of stainless steel, carbon steel, copper or aluminum

DRAIN PANS

- 304L 16 gauge stainless steel
- Lead Time - 10 working days
- Designed per customer's drawing

HEATCRAFT™

LUVATA

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