

LAMILINE

FACE AND BY-PASS COIL
DAMPER UNITS

REV. 1
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ROSEMEX PRODUCTS

HEATING

INDEX

LAMILINE FACE AND BY-PASS COIL/DAMPER UNITS provide an effective and convenient method of preheating fresh air supply to a controlled leaving temperature with a minimum risk of freezing the coil. The arrangement of alternate narrow coil and by-pass sections provides effective mixing of the streams of heated and unheated air, and the temperature of the mixed air is controlled by modulating the face and by-pass dampers.

By keeping the steam (or water temperature and flow) "full-on" until the entering air temperature is well above freezing (40-50°), the possibility of freezing the coil is almost eliminated. Overheating during the period when the entering air is near the required temperature for leaving air, and the face dampers are fully closed (but where it is not considered safe to modulate the steam or water), is minimized by special damper seals.

Additionally, a down-stream damper inter-linked with the face and by-pass dampers so that it remains fully open for most of the control range, and closes rapidly at the end of the control range as the face damper becomes fully closed, is normally provided. This damper is of double construction with hollow crosssection and acts as a heat baffle to reduce radiation from the face of the coil.

By this combination of special damper seals and heat baffle the temperature over-ride can be kept to a maximum of from 5-8° which is usually easily compensated for in the reheating further down-stream.

ALL LAMILINE DAMPERS are special extruded aluminum shapes designed for rigidity, and because extrusions are always uniform a good fit is assured. Proper positioning of the dampers and damper seal mullions is assured in manufacture by the use of a multiple punch and die set which simultaneously punches all of the damper shaft and mullion screw holes for each section of the LAMILINE unit.

LAMILINE units are offered with vertical tubes for steam applications and with horizontal tubes for water and steam applications. The vertical tube units are recommended where steam is being used for preheating applications because there is less possibility of freezing. The "single-pass" construction, with the steam header at the top and the condensate header at the bottom provides for rapid clearing of condensate. The headers are generously sized to assure good steam distribution, and the condensate header is the same size as the steam header to take care of surges of condensate which may occur on start up and as an added safety precaution against "back-up" of condensate.

WHERE HORIZONTAL TUBE STEAM LAMILINE units seem to be indicated for a preheating application due to the configuration of the inlet opening, good results can be obtained by using extra care in selection and installation. If available space permits, singlepass coils (opposite end headers) should be used, and the unit should be sloped approximately 1/4 inch per foot toward the condensate end. There is no built-in slope in the LAMILINE units.

If a two-pass (same end header) coil must be used it should be limited to 60 inches in length, and care must be taken to see that the unit is installed with the tubes absolutely level, as any slope in either direction may cause "water-hammer" and would also increase the danger of freezing.

WHERE HOT WATER UNITS ARE USED FOR PREHEATING, the water must be kept at full flow rate through the coil and preferably at full temperature until the entering air is well above freezing. Ethylene Glycol solutions may be used, and information is included in the water coil selection data as to the adjustments to be made in calculations.

LAMILINE face and by-pass units are also suitable for applications not involving freezing air. The available selection of sizes (9" increments in width and 1" increments in length) lends itself to fitting LAMILINES to standard air handling units.

LAMILINE face and by-pass coil damper unit casings are one-piece welded construction of heavy gauge galvanized steel. Corners are gusseted to prevent twisting of the casing. A special welding process is used which minimizes damage to the galvanized coating of the steel and a "galvacon" coating is applied over the weld as a further protection.

COIL SEGMENTS are of copper tube mechanically expanded into aluminum plate fins. (Copper fins are available at added cost.) Coils are one-or two-row construction, but it is recommended that for preheating applications two-row always be used. Two-row segments have staggered tubes to minimize the by-pass factor of the coil. Fin spacing is between 4 FPI or 12 FPI.

HEADERS are electric welded steel pipe, and the tubes are brazed into the headers. In vertical tube units the coil segments are attached to the upper tube sheet and float freely in the lower tube sheet to allow for expansion. The tube sheets have flanged holes through which the tubes pass and in which they can move without damage to the tubes.

EXPANSION BENDS are provided at the lower end of the tubes of vertical tube units, and at the condensate header end of horizontal tube units having opposite end headers, to allow for expansion and contraction. Steam units having same end headers have special return bends which allow for expansion and contraction. Hot water units with opposite end headers have the expansion bends at the return header in order to provide the off-setting of the header required to facilitate coil segment removal.

EXPANSION OF THE HEADERS is allowed for in the method of attaching the individual tube sheets to the main casing, which allows for adequate side movement.

REMOVAL OF INDIVIDUAL COIL SEGMENTS is possible without disturbing the headers or piping. This is illustrated in the pictures on the opposite page. Removal is from the down-stream side after having first removed the down-stream damper.

No extra space need be provided above or below the coil (or on either end in the case of horizontal tube units) for pulling of damper shafts. The construction of the blades, which can be seen in the illustration on page 6, is such that continuous shafts are not required and the blade can be removed by simply unbolting the blades from the damper shaft at each end. In the case of long blades which are divided into two or more sections the intermediate bearing supports are removable. Removal of the coil segment itself is done by cutting the tubes between the coil and header. The new segment is then inserted and the tubes connected by means of standard copper sleeves which are silver brazed in place. This provides an easily made and permanent leak-free joint.

REMOVAL OF FACE AND BY-PASS DAMPERS is also possible without requiring any additional space around the unit by the same means as described above for the downstream damper removal. The construction of the damper blades and mullions are described and illustrated on page 6.

DAMPER LINKAGE is installed on the supply end of vertical tube units, and on the supply end of horizontal tube units, unless specifically requested otherwise. In each case a damper drive shaft with an adjustable arm for attaching the drive rod runs the full height or length of the unit. In this way the connecting rod from the damper motor may be attached at either end of the unit or at any intermediate point. A detail of this arrangement can be seen on page 7.

DAMPER DRIVE MOTORS should be selected according to the control manufacturer's recommendations for an equivalent area of opposed blade standard damper. Due to their light weight and operating in graphite bushings LAMILINE dampers are relatively light operating. However, it is not recommended that any special allowances be made when selecting damper drive motors.

DOUBLE COIL SECTION UNITS are available for duties requiring a higher temperature rise than is possible with a single coil section. These are supplied in a two piece casing as illustrated on pages 17 and 19. Removal of an inner coil segment requires removal of the outer coil segment, or alternatively if circumstances allow the casing may be separated to allow access to the inner coil section.

STANDARD STEAM COILS are suitable for steam pressures to 15 PSIG and temperatures to 275°F.

HEAVY DUTY STEAM COILS may be used for steam pressures to 150 PSIG and temperatures to 350°F.

STANDARD WATER COILS are suitable for water temperatures to 250°F and pressures to 160 PSIG.

HEAVY DUTY WATER COILS may be used for water temperatures to 350°F and pressures to 200 PSIG.

TESTING of all water and steam coils is done under water in an illuminated test tank with air at 350 PSIG.

VERTICAL TUBE LAMILINE UNITS TYPE LLS-V

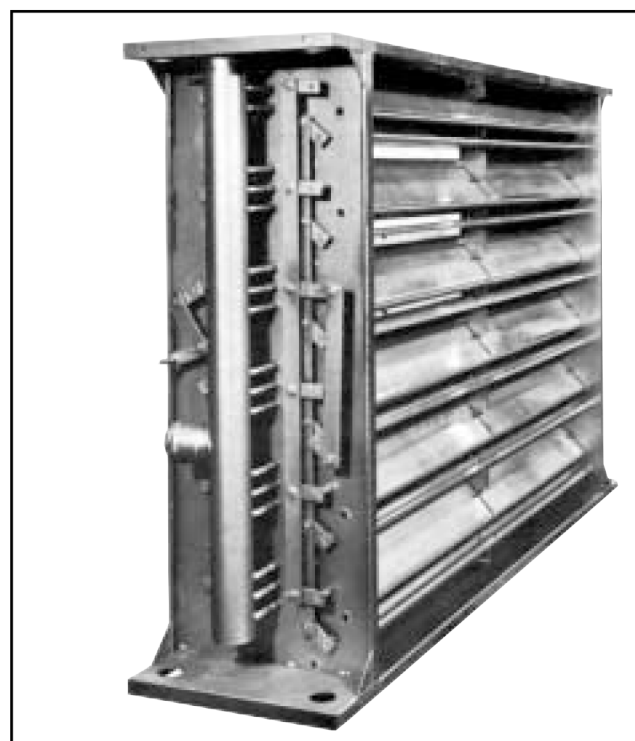


Entering air side



Leaving air side

HORIZONTAL TUBE LAMILINE UNITS TYPE LLW-H AND LLS-H



Entering air side



Leaving air side

SMOOTH AIRFLOW through LAMILINE mixing dampers is maintained by their diverting rather than baffling action, so that at no time is a flat surface or pocket presented to the air stream. A single cross-link between the face dampers and by-pass dampers of each unit is provided.

Another cross-link ties in the down-stream dampers. The design of this link is such that there is very little movement of the down-stream blade during most of the travel of the face and by-pass blades. As the face blades near the fully closed position this link moves the downstream blades rapidly toward the closed position, so that by the time the face blade has fully closed the downstream blade is also closed.

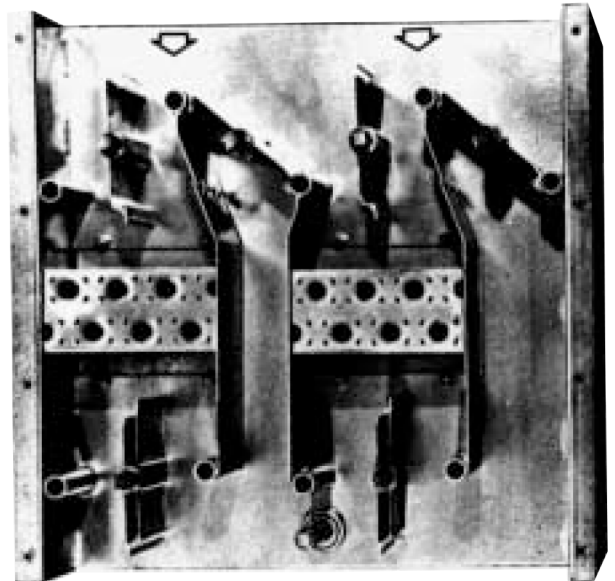
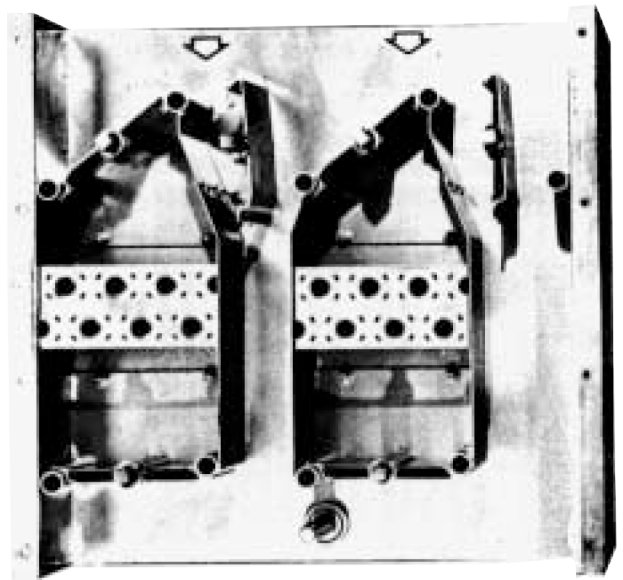
DAMPER BLADES are extruded aluminum shapes specially designed for the LAMILINE units. The heavy cross section of the blades prevents warping, and the heavy hub section eliminates the need of a continuous shaft. This is important to the easy coil removal described on page 4, or in the event of accidental damage to a blade.

The "flat" in the hub positions the blade on the shaft. When the damper link arm is welded to the shaft it is accurately positioned in a "Jig" so that the flat on the shaft and thereby the position of the damper arm with relation to the blade is accurately maintained. A steel bolt is inserted through the hub and shaft to keep the shaft in position, but no force is exerted on this bolt to drive the damper blade.

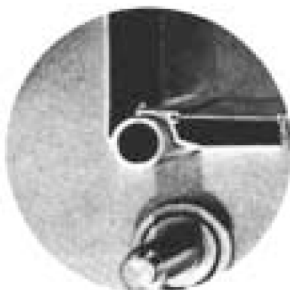
DAMPER SEALS are effected by the contoured shape of the extruded blade, matching that of the mullion. No sealing strips are required due to the labyrinth formed when the blade moves to the closed position.

DOWN-STREAM DAMPERS are of a three-piece extruded aluminum shape having a hollow cross-section which acts as an effective heat baffle. A seal is provided on the down stream damper. The down-stream damper may be omitted with some saving in cost in applications where it may not be considered necessary.

DAMPER BUSHINGS are of nylon, and never require lubrication. The smooth operation of the nylon bushings is unaffected by temperature, unlike oil impregnated bronze bushings which become gummy and heavy operating when exposed to extreme temperatures.

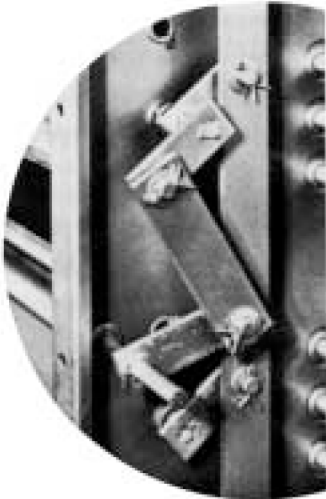


Cross section (Plan View)
Type LLS-V vertical tube steam
(Shown in full heating)



Damper seals

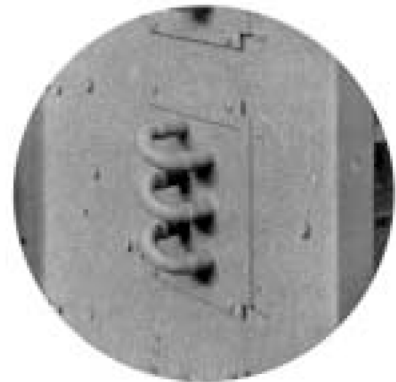




Continuous damper drive shaft allows for driving the damper from either end or any intermediate point.



Heavy duty linkage



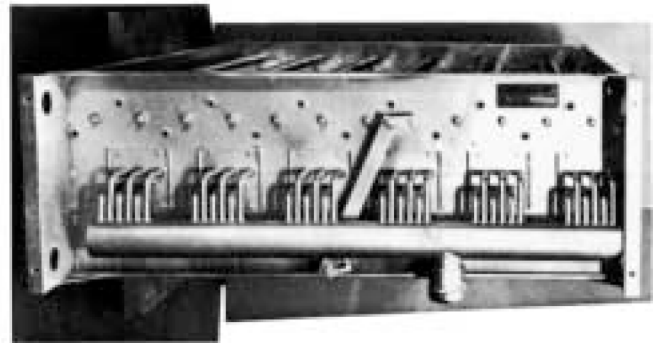
Standard return bends used for water coils. Special expansion bends are used for steam coils.

HORIZONTAL TUBE LAMILINE UNITS for hot water are available with same end or opposite end headers, in face lengths up to 116" in 1" increments. Steam units with horizontal tubes should be limited to 60" in length for same end headers, but are available up to 116" with opposite end headers. Horizontal tube steam units with same end headers have special off-set return bends to allow for expansion and contraction. Opposite end header units have expansion bends as described below.

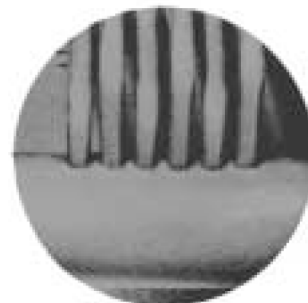
VERTICAL TUBE LAMILINE UNITS are always single pass and have the steam header at the top and the condensate header at the bottom. Tubes are off-set before entering the condensate header as shown in the illustration to the right. This allows for expansion and contraction and also provides for coil segment removal as described on page 4. Tubes are fixed to the top tube sheet, and float freely in flanged holes in the lower tube sheet. Expansion in the length of the header is provided for in the method of attaching the individual tube sheets to the main frame.

DAMPER LINKAGE is always installed at the supply end of vertical tube units, and on the supply end of horizontal tube units unless specifically requested otherwise. The continuous damper drive shaft as illustrated above allows for connecting the drive rod from the damper motor at either end of the unit or at any intermediate point.

SILVER BRAZED CONNECTIONS are standard on all LAMILINE units.



Bottom view of vertical tube unit



Silver brazed connection

CIRCUITING of type W LAMILINE units is stated as the number of individual paths for water between the supply header and the return header, regardless of how many passes across the face of the coil may be made in the process. This number will be identified by the number of tubes entering the supply header (which will also equal the number of tubes entering the return header).

Table 1 lists the choice of circuiting for each face height of unit, and also the number of passes so that the head loss can be determined from Chart 1. The number of GPM/circ. is found by dividing the total GPM determined for the total load (see page 9) by the number of circuits.

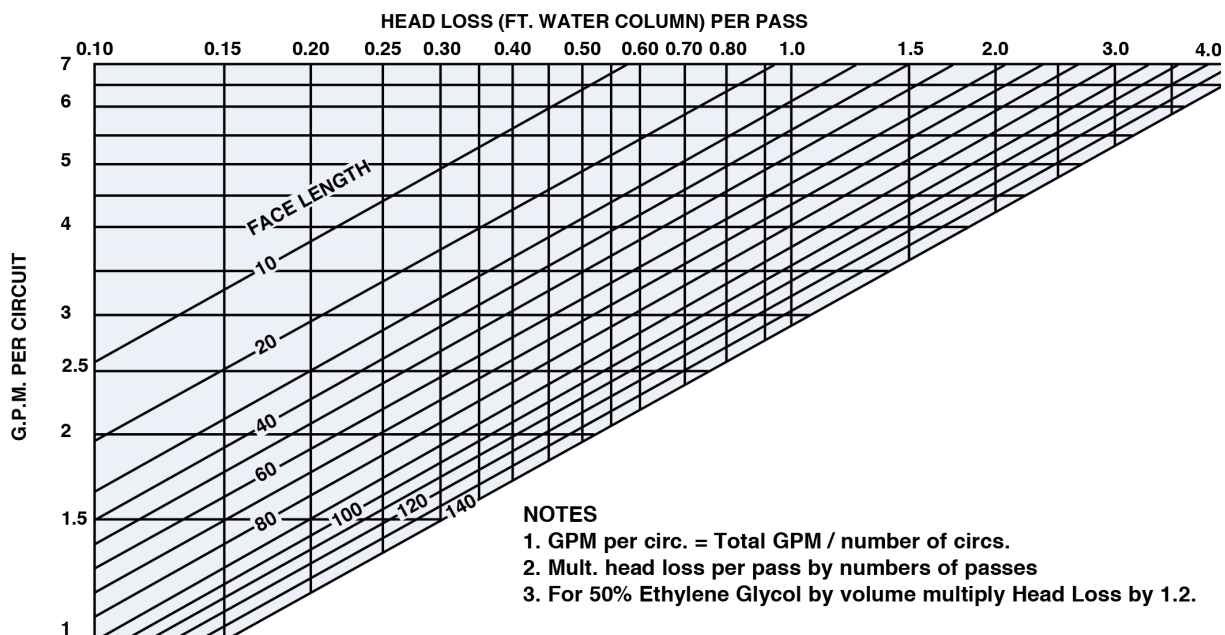
In the column headed "Two-coil sections, each two row" the number of circuits shown is the total for the two-coil sections, and so the total GPM should be divided by this figure to determine the GPM/circ. Each coil section should be connected to the supply and return mains. The water should not be passed through the two-coil sections in series.

Left or right position of supply and return headers is determined while facing the air outlet side of the unit.

TABLE 1
AVAILABLE CIRCUITING ARRANGEMENTS
TYPE LLW-H LAMILINE UNITS

FACE HEIGHT	1-COIL SECTION 1 ROW				1-COIL SECTION 2 ROW				2-COIL SECTION EACH 2 ROW			
	Headers S.E.		Headers O.E.		Headers S.E.		Headers O.E.		Headers S.E.		Headers O.E.	
	CIRCS.	PASSES	CIRCS.	PASSES	CIRCS.	PASSES	CIRCS.	PASSES	CIRCS.	PASSES	CIRCS.	PASSES
18"	2	4	—	—	2	8	—	—	4	8	—	—
	4	2	8	1	8	2	16	1	16	2	32	1
27"	3	4	—	—	3	8	—	—	6	8	—	—
	6	2	12	1	12	2	24	1	24	2	48	1
36"	4	4	—	—	4	8	—	—	8	8	—	—
	8	2	16	1	16	2	32	1	32	2	64	1
45"	5	4	—	—	5	8	—	—	10	8	—	—
	10	2	20	1	20	2	40	1	40	2	80	1
54"	6	4	—	—	6	8	—	—	12	8	—	—
	12	2	24	1	24	2	48	1	48	2	96	1
63"	7	4	—	—	7	8	—	—	14	8	—	—
	14	2	28	1	28	2	56	1	56	2	112	1
72"	8	4	—	—	8	8	—	—	16	8	—	—
	16	2	32	1	32	2	64	1	64	2	128	1

CHART 1
HEAD LOSS CHART



SELECTION OF TYPE W LAMILINE UNITS

FACE AREAS and face dimensions for horizontal tube LAMILINE units are given in Table 2. Overall dimensions and weights are given on page 16. The shape and size of the unit selected for any given application will depend on the available space and the volume of air to be handled, and to some extent on the temperature rise required.

SELECTION OF THE UNIT to be used may be influenced by duct or louver sizes or other equipment down stream of the LAMILINE unit. In this case rows and fin spacing would be selected to accommodate the temperature rise required. On the other hand, if the size of the LAMILINE unit is not governed by such considerations, then it may be decided to use, for example, a two-row 6 FPI coil section, and the required square foot area can be calculated from the air velocity indicated for that duty from Chart 3 on page 11.

Wherever possible a unit with a single coil section should be used in order to avoid the cost of the second coil section and the extra piping involved.

WHERE THE SIZE AND SHAPE OF THE LAMILINE UNIT TO BE USED IS GOVERNED BY THE PHYSICAL CHARACTERISTICS OF THE SYSTEM proceed as follows:

1. CALCULATE THE HEAT LOAD and the US GPM of water required as follows: $CFM \times \text{Air T.R.} \times 1.09 = \text{BTUH Load}$
 $\text{BTUH}/500 \times \text{water T.D.} = \text{US GPM}$
or
 $\text{BTUH}/500 \times \text{US GPM} = \text{water T.D.}$ FOR 50% ETHYLENE GLYCOL BY volume: $\text{BTUH}/500 \times 0.85 \times \text{T.D.} = \text{US GPM}$
or
 $\text{BTUH}/500 \times 0.85 \times \text{US GPM} = \text{T.D.}$
2. SELECT THE UNIT to be used from Table 2, with reference to the overall dimension table on page 16 as required.
3. FIND THE GPM/CIRC. AND HEAD LOSS as outlined on page 8.

TABLE 2
SQ. FT. FACE AREA* — HORIZONTAL TUBE UNITS

FACE HEIGHT	FACE LENGTH																						
	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116
18	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00	9.50	10.00	10.50	11.00	11.50	12.00	12.50	13.00	13.50	14.00	14.50
27	5.25	6.00	6.75	7.50	8.25	9.00	9.75	10.50	11.25	12.00	12.75	13.50	14.25	15.00	15.75	16.50	17.25	18.00	18.75	19.50	20.25	21.00	21.75
36	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00
45					13.75	15.00	16.25	17.50	18.75	20.00	21.25	22.50	23.75	25.00	26.25	27.50	28.75	30.00	31.25	32.50	33.75	35.00	36.25
54							19.50	21.00	22.50	24.00	25.50	27.00	28.50	30.00	31.50	33.00	34.50	36.00	37.50	39.00	40.50	42.00	43.50
63									26.25	28.00	29.75	31.50	33.25	35.00	36.75	38.50	40.25	42.00	43.75	45.50	47.25	49.00	50.75
72											34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00	52.00	54.00	56.00	58.00

- NOTES:**
1. Increments of height are fixed. Increments of length may be interpolated as required.
 2. Steam coils over 60" long should be single pass (Supply and condensate at opposite ends).
 3. Selections in shaded area should be avoided where possible for structural reasons.

4. FIND THE L.M.T.D. (log. mean temperature difference) between the water and air during the heating process from Chart 2 on page 10. Where the "Range" is less than 25° use the arithmetic average of the entering and leaving temperature differences. The error in this is less than one degree in the L.M.T.D.

ENTER THE CHART ON PAGE 11 at the already known face velocity (try first in the 6 FPI coil section) and following the route of the dotted example line proceed to GPM/circ., down to the L.M.T.D. line, and left to find the temperature rise for a one- or two-row coil section. If sufficient temperature rise is not indicated repeat the process using the 12 FPI Coil Section of the chart.

If the LAMILINE unit is to be used for pre-heating outside air always select a two-row coil in order to minimize the by-pass factor.

5. FIND THE AIR FRICTION LOSS from Table 3.

TABLE 3
AIR FRICTION LOSS (IN. SWG)
MARK III LAMILINE UNITS

FACE VELOCITY FPM	1 COIL SECTION				ADD FOR SECOND COIL SECTION (2 ROW)	
	6 FPI		12 FPI		6 FPI	12 FPI
	1R	2R	1R	2R		
300	0.05	0.08	0.08	0.11	0.06	0.08
400	0.08	0.13	0.12	0.18	0.10	0.15
500	0.13	0.19	0.18	0.29	0.14	0.24
600	0.19	0.27	0.24	0.38	0.20	0.31
700	0.26	0.35	0.32	0.50	0.25	0.40
800	0.32	0.45	0.40	0.63	0.32	0.50
900	0.38	0.55	0.48	0.74	0.39	0.59
1000	0.50	0.67	0.58	0.89	0.47	0.69

WHERE THE FACE AREA OF THE LAMILINE UNIT TO BE USED IS TO BE GOVERNED BY THE REQUIRED AIR TEMPERATURE RISE, proceed as follows:

1. DETERMINE THE HEAT LOAD and US GPM in Step 1 on the previous page.
2. FIND THE L.M.T.D. as in Step 4 on the previous page.
3. ENTER THE CHART ON PAGE 11 at the required temperature rise (in the Two-Row column if the unit is to be used for pre-heating) and following the route of the example line proceed to the L.M.T.D., up to the 2 GPM/circ. line for either a 6 FPI or a 12 FPI coil, and left to find the maximum face velocity compatible to the required air temperature rise.
4. FIND THE FACE AREA required on the basis of the CFM and the face velocity as indicated.
5. SELECT A UNIT with the required face area from Table 2 on page 9.
6. CIRCUIT THE COIL as outlined on page 8 and find GPM/circ. and head loss.
7. CHECK THE UNIT SELECTION on the Chart on page 11 to confirm the actual air temperature rise at the now fixed face velocity and GPM/circ.

A SAFETY MARGIN OF 20% has been built into the selection chart to cover discrepancies in system balancing such as over volume of air, under volume of water etc., so that it should not be necessary to make any further allowances.

FOR ETHYLENE GLYCOL SOLUTIONS of 50% by volume:

- a. Increase the total US GPM for water by approx. 18% ($\text{BTUH}/500 \times 0.85 \times \text{water T.D.} = \text{US GPM required}$)
- b. Read GPM/circ. on Chart at actual GPM/2.2 (Flow of 2.2 GPM/circ. = 1 GPM/circ. of water).
- c. Multiply head loss read for actual GPM/circ. by 1.2.

Left or right position of supply and return headers is determined while facing the air outlet side of the unit.

MODEL NUMBERS are descriptive:
e.g. LLW-H 6 FPI-36X64-D-RH:

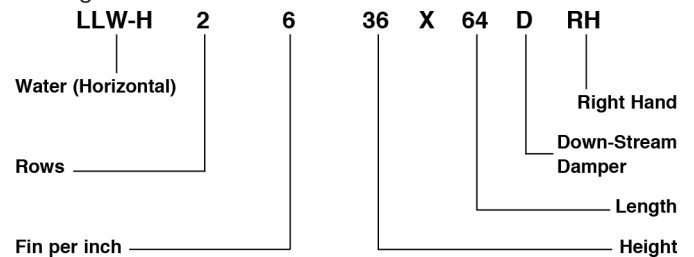


CHART 2
L.M.T.D. CHARTS

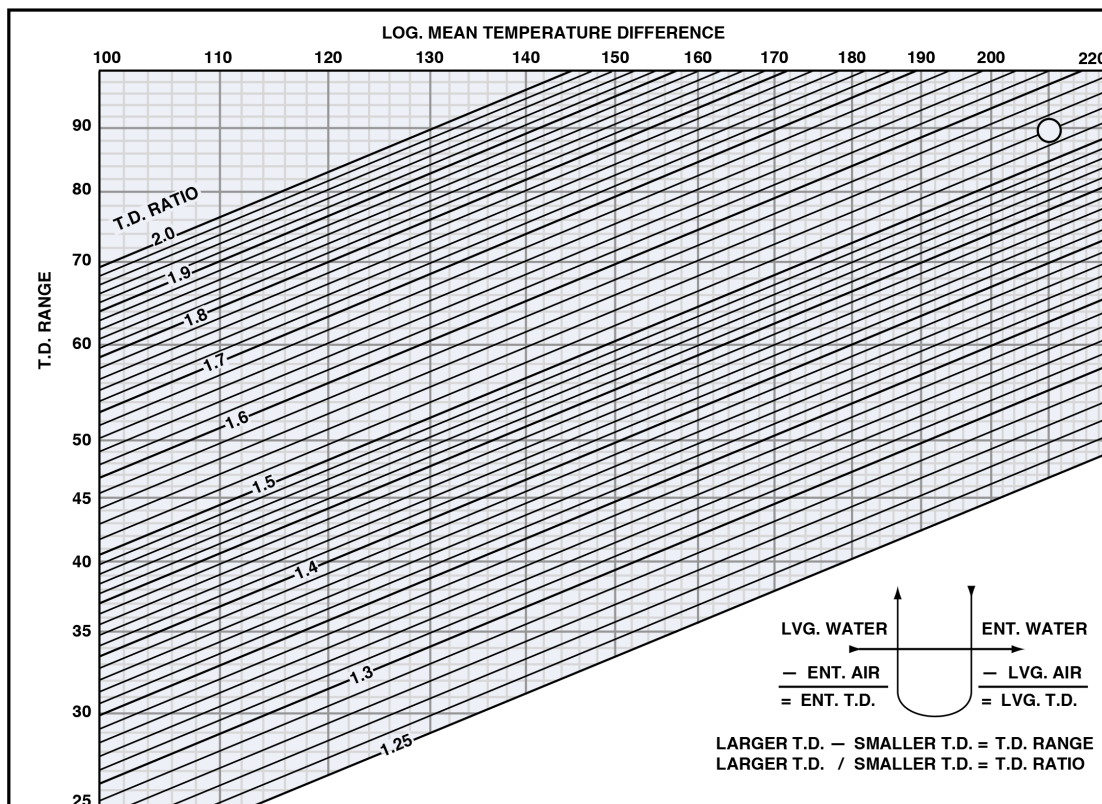
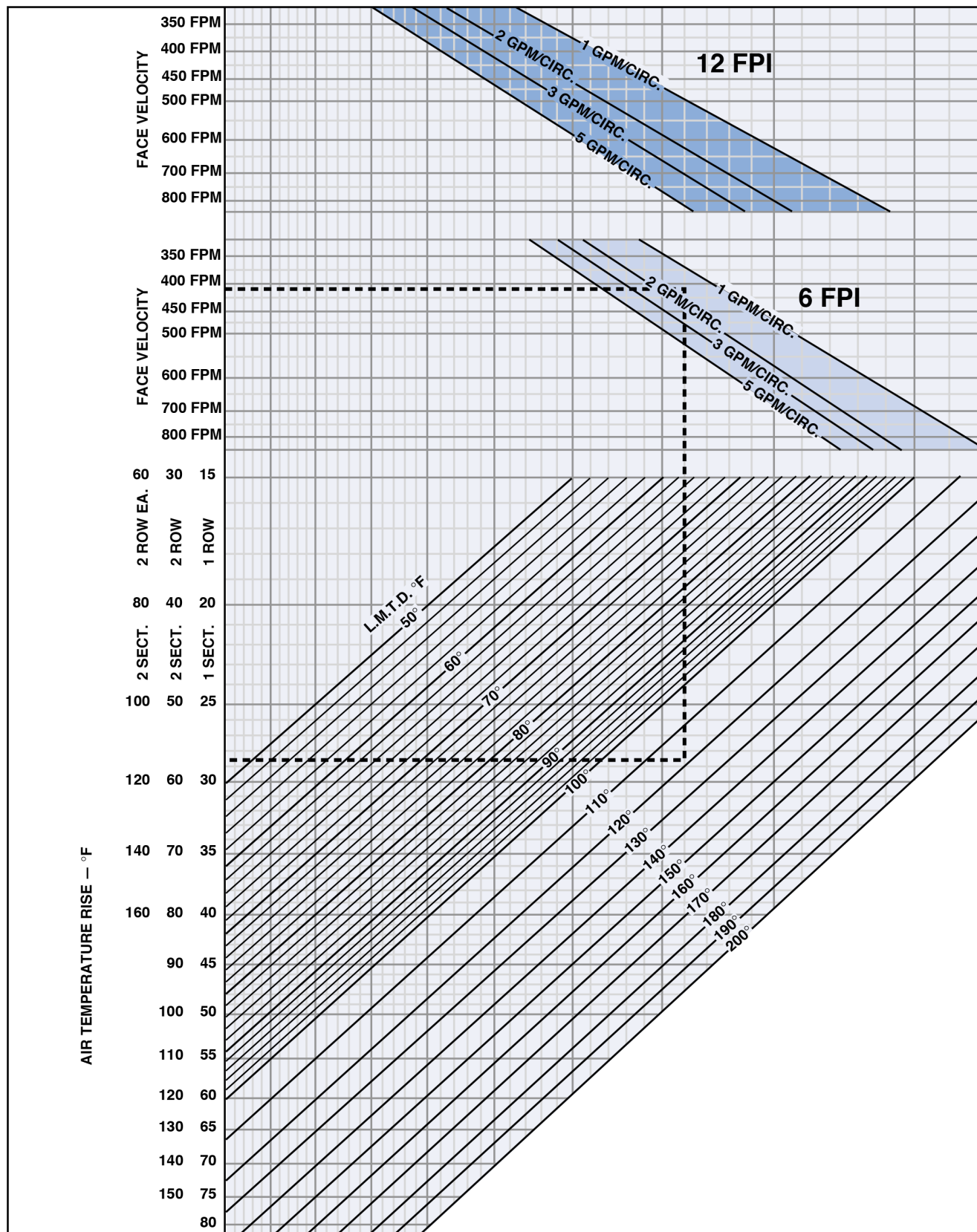


CHART 3
TYPE W LAMILINE
TEMPERATURE RISE CHART



VERTICAL OR HORIZONTAL TUBE

FACE AREAS for type S LAMILINE units are given in Tables 2 and 4. The shape and size of the unit selected will depend on the available space and the volume of air to be handled, and to some extent on the temperature rise required. SELECTION OF THE UNIT to be used may be influenced by duct or louver sizes or other equipment down-stream of the LAMILINE unit. In this case rows and fin spacing would be selected to accommodate the temperature rise required. Alternatively, it may be decided to use, for example, a two-row 6 FPI coil section and find the minimum square foot area that will provide the required air temperature rise.

If the unit is to be used for pre-heating outside air, always select a two row coil in order to minimize the by-pass factor.

Vertical tube steam units are recommended for pre-heating applications. If a horizontal tube steam unit seems to be indicated, select a unit with opposite end headers if space permits, and slope the unit toward the condensate header. If a unit with same end headers must be used, the length should be limited to 60 inches, and the unit must be installed absolutely level to guard against water-hammer or build up of condensate in the tubes.

WHERE THE SIZE AND SHAPE OF THE LAMILINE UNIT TO BE USED IS GOVERNED BY THE PHYSICAL CHARACTERISTICS OF THE SYSTEM proceed as follows:

1. SELECT THE UNIT from Table 4 for vertical tube, or Table 2 on Page 9 for horizontal tube units. For overall dimensions and weights, see pages 16 to 19 inclusive.
2. FIND THE ENTERING T.D. This is the temperature difference between the steam temperature and the entering air temperature.
3. ENTER THE CHART ON PAGE 13 at the required air temperature rise, proceed to the entering T.D., up to the horizontal face velocity line (try first in 6 FPI coil section) and find the number of rows and fin spacing required.
4. CHECK FOR THE MAXIMUM temperature rise by extending the face velocity line to the maximum for the rows selected, down to the entering T.D., and left to read the maximum temperature rise.
5. FIND THE AIR FRICTION LOSS from Table 3.
6. FIND THE LB CONDENSATE PER HOUR.
 - a. CFM x Air T.R. x 1.09 — BTUH Load.
 - b. BTUH/BTUH per lb condensate hr (page 14) = Total Lb hr. Size traps for 3 to 4 times this figure.

WHERE THE FACE AREA IS TO BE GOVERNED BY REQUIRED AIR TEMPERATURE RISE follow Steps 2, 3, 5 and 6 above, but in Step 3 instead of stopping at a predetermined face velocity continue upward to the maximum limit line of a 1 or 2-row coil, and read the maximum face velocity at which the required air temperature rise can be obtained. The minimum unit area can now be determined on the basis of this face velocity.

A SAFETY MARGIN OF 20% has been built into the selection chart to cover discrepancies in system balancing such as over volume of air, reduced steam supply, etc., so that it should not be necessary to make any further allowances.

MODEL NUMBERS are descriptive:
e.g. LLS-V 6 FPI-64X36-D:

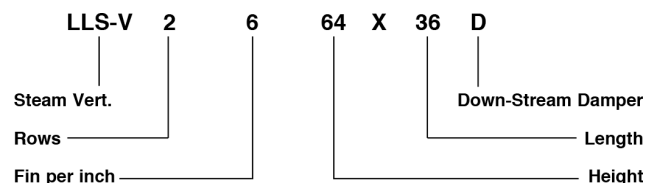
TABLE 3
AIR FRICTION LOSS (IN. SWG)
MARK IV LAMILINE UNITS

FACE VELOCITY FPM	1 COIL SECTION				ADD FOR SECOND COIL SECTION (2 ROW)	
	6 FPI		12 FPI		6 FPI	12 FPI
	1R	2R	1R	2R		
300	0.05	0.08	0.08	0.11	0.06	0.08
400	0.08	0.13	0.12	0.18	0.10	0.15
500	0.13	0.19	0.18	0.29	0.14	0.24
600	0.19	0.27	0.24	0.38	0.20	0.31
700	0.26	0.35	0.32	0.50	0.25	0.40
800	0.32	0.45	0.40	0.63	0.32	0.50
900	0.38	0.55	0.48	0.74	0.39	0.59
1000	0.50	0.67	0.58	0.89	0.47	0.69

TABLE 4
SQ. FT. FACE AREA* — VERTICAL TUBE UNITS

FACE HEIGHT	FACE LENGTH									
	27	36	45	54	63	72	81	90	99	108
28	5.25	7.00								
36	6.75	9.00								
40	7.50	10.00	12.50							
44	8.25	11.00	13.75							
48	9.00	12.00	15.00							
52	9.75	13.00	16.25	19.50						
56	10.50	14.00	17.50	21.00						
60	11.25	15.00	18.75	22.50	26.25					
64	12.00	16.00	20.00	24.00	28.00					
68	12.75	17.00	21.25	25.50	29.75	34.00	38.25	42.50	46.75	51.00
72	13.50	18.00	22.50	27.00	31.50	36.00	40.50	45.00	49.50	54.00
76	14.25	19.00	23.75	28.50	33.25	38.00	42.75	47.50	52.25	57.00
80	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00	55.00	60.00
84	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	63.00
88	16.50	22.00	27.50	33.00	38.50	44.00	49.50	55.00	60.50	66.00
92	17.25	23.00	28.75	34.50	40.25	46.00	51.75	57.50	63.25	69.00
96	18.00	24.00	30.00	36.00	42.00	48.00	54.00	60.00	66.00	72.00
100	18.75	25.00	31.25	37.50	43.75	50.00	56.25	62.50	68.75	75.00
104	19.50	26.00	32.50	39.00	45.50	52.00	58.50	65.00	71.50	78.00
108	20.25	27.00	33.75	40.50	47.25	54.00	60.75	67.50	74.25	81.00
112	21.00	28.00	35.00	42.00	49.00	56.00	63.00	70.00	77.00	84.00
116	21.75	29.00	36.25	43.50	50.75	58.00	65.25	72.50	79.75	87.00

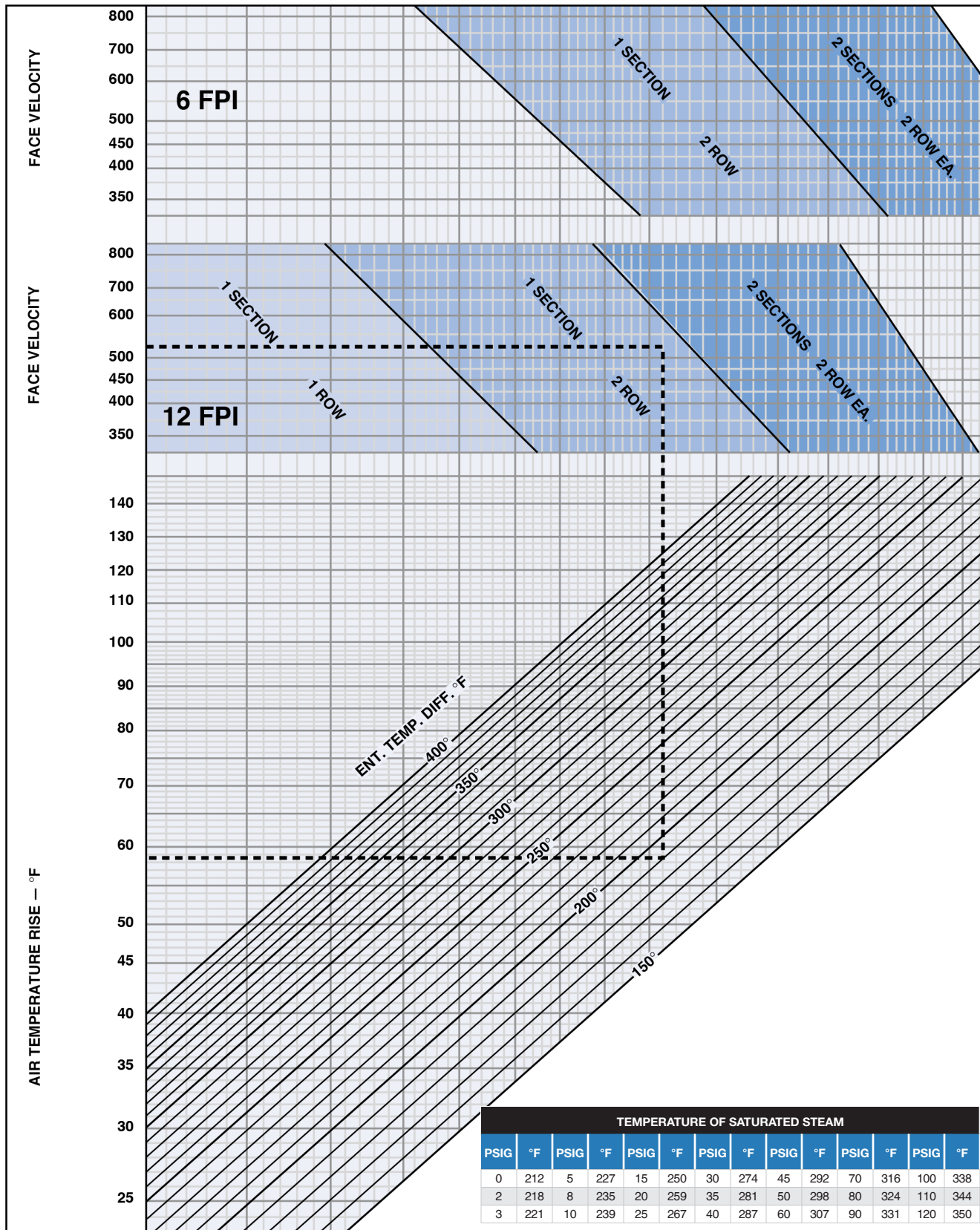
Avoid selecting units in shaded area wherever possible. (See page 19).



NOTE: Increments of length are fixed. Increments of height may be interpolated as required. (See Page 9 Table 2 for Horizontal Tube Units) * Full face area inside casing

Left or right position of supply and return headers is determined while facing the air outlet side of the unit.

CHART 4
TYPE S LAMILINE
TEMPERATURE RISE CHART



LAMILINE units are installed and piped according to usual practice for water and steam coils. The following general rules should be observed.

TYPE W UNITS

1. LEVEL THE COIL to assure emptying of all tubes when draining.
2. SUPPORT PIPING INDEPENDENTLY of the coil.
3. CONNECT SUPPLY TO BOTTOM, RETURN TO TOP, to avoid air-locking of individual tubes. Connections may be reversed where conditions demand, but special attention must be given to venting. Single circuit coils may be connected either way.
4. MULTI-ROW COILS should have the supply on the leaving side (Counter flow). Parallel flow will reduce capacity up to 20%.
5. INDIVIDUAL DRAINING of each coil to an open floor drain is recommended. Coupling of drain lines together can result in water being "air-trapped" in tubes.
6. VENT RETURN LINES as near as possible to each coil when draining, and remove the vent plugs from the coil headers.

TYPE S UNITS

1. INSTALL VERTICAL TUBE UNITS with steam header at the top, condensate header at the bottom.

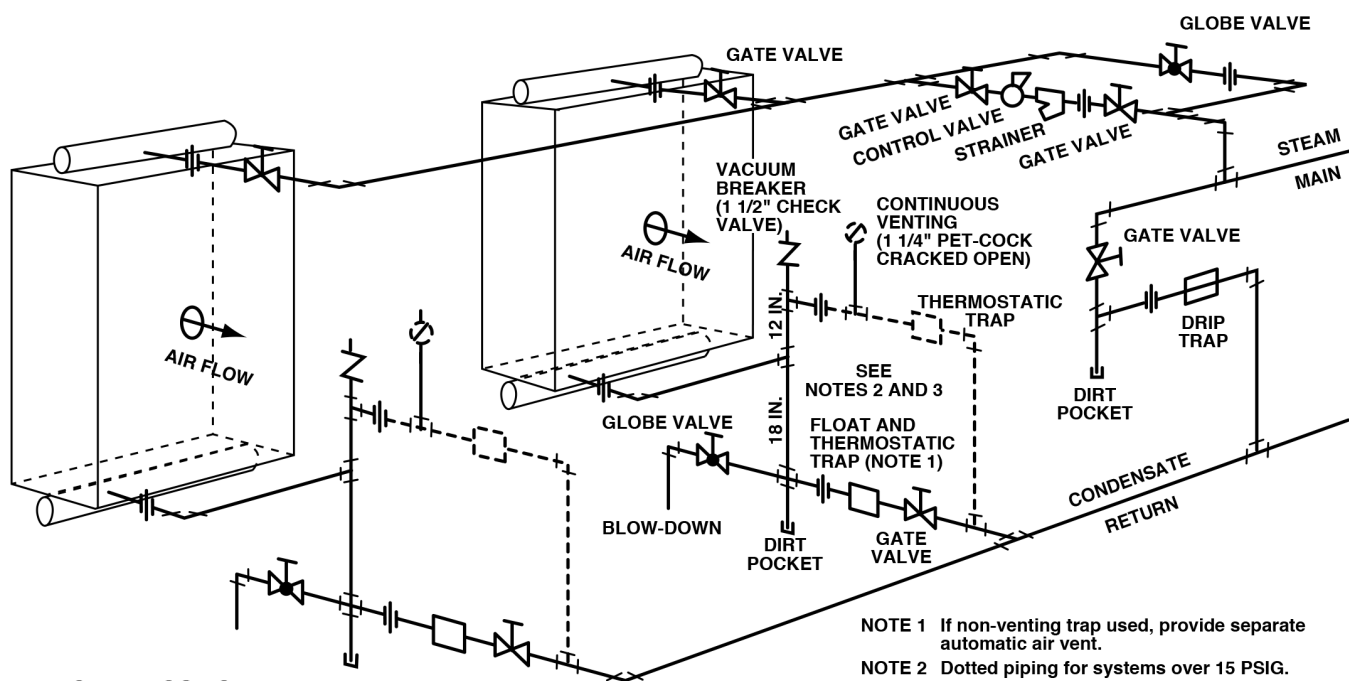
INSTALL HORIZONTAL TUBE UNITS with opposite end headers sloped 1/4" per foot toward condensate header. With same end headers install absolutely level.

2. SUPPORT PIPING INDEPENDENTLY of the coil, and provide "swing-joints" to absorb the strain of expansion and contraction.
3. SIZE CONTROL VALVES FOR THE STEAM LOAD, not for the size of the coil connection.

4. DO NOT MODULATE THE STEAM SUPPLY at air temperatures below plus 40°F. A minimum steam pressure of 5 PSIG is recommended for lower air temperatures.
5. DO NOT REDUCE THE CONDENSATE CONNECTION at the coil, maintain full size to the trap.
6. PROVIDE A COOLING LEG of at least 18 in. before the trap where possible (minimum of 12 in.), with a dirt pocket at the lower end.
7. SIZE TRAPS for 3 to 4 TIMES NORMAL operating load.
8. TRAP EACH COIL INDIVIDUALLY.
9. VENT COILS to remove non-condensable gases. Low Pressure installations (up to 15 PSIG) may be equipped with traps with thermostatic air vents, or with separate automatic air vents. High Pressure installations (over 15 PSIG) must be provided with continuous venting in addition to thermostatic traps or automatic air vents.
10. VACUUM BREAKERS must be provided on all condensate return lines except on vacuum return systems, where a by-pass utilizing a thermostatic trap should be substituted for the vacuum breaker.
11. DO NOT ALLOW BELOW FREEZING AIR to pass over a shut-down coil. Moisture remaining in the tubes will freeze, and may result in complete freeze-up due to blockage when the steam is turned on.

LATENT HEAT OF SATURATED STEAM — BTH HR. / LB CONDENSATE HR.

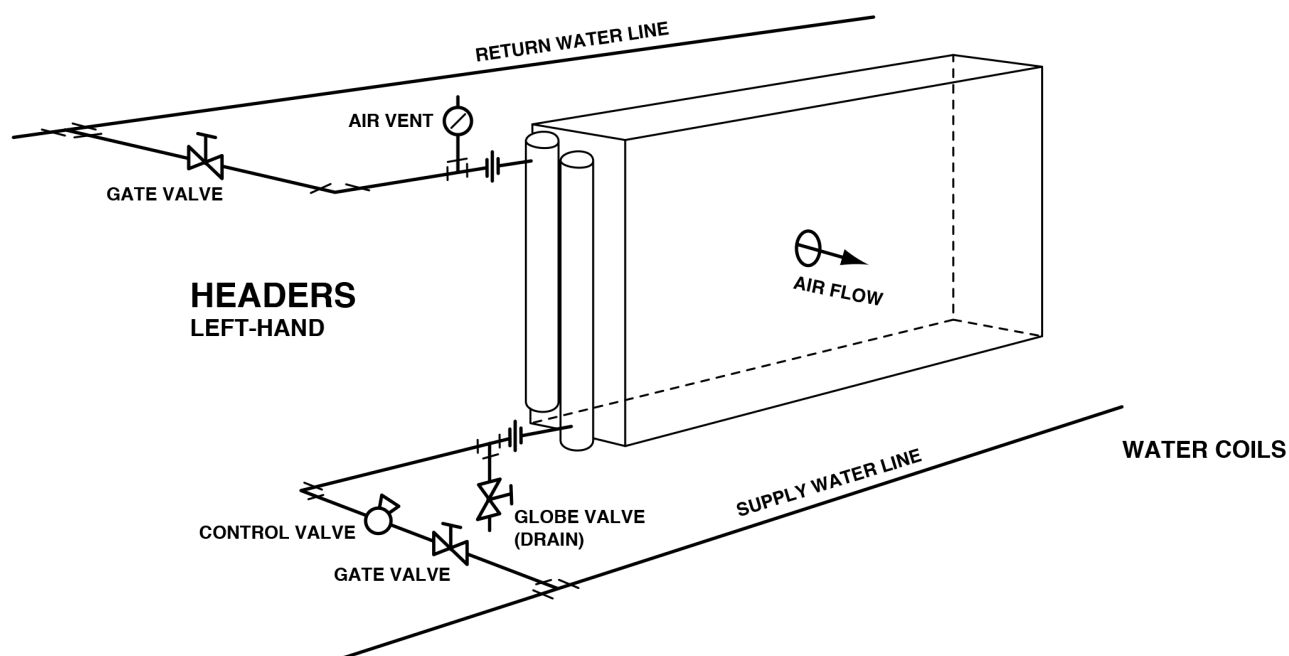
PSIG	BTU	PSIG	BTU	PSIG	BTU	PSIG	BTU	PSIG	BTU	PSIG	BTU	PSIG	BTU
0	970	5	960	15	945	30	928	45	915	70	897	100	881
2	966	8	955	20	939	35	924	50	911	80	891	110	875
3	964	10	952	25	933	40	919	60	904	90	885	120	870



NOTE 1 If non-venting trap used, provide separate automatic air vent.

NOTE 2 Dotted piping for systems over 15 PSIG.

NOTE 3 For vacuum return systems pipe as for high pressure but omit vacuum breaker and operate with pet-cock closed.



TYPICAL SPECIFICATIONS FOR TYPE LLW-H (WATER) OR TYPE LLS-H (STEAM) LAMILINE UNITS

FACE AND BY-PASS COIL/DAMPER UNITS SHALL BE LAMILINE MARK V DESIGN, TYPE LLW-H. (Substitute LLS-H if steam is to be used.)

These units shall consist of alternate horizontal coil and by-pass sections in a galvanized steel casing of not less than 14 gauge.

COIL SECTIONS shall be of copper tubes with aluminum fins, no less than 2 rows deep and not more than 6 inches wide. Each section shall be individually removable from the down-stream side of the unit without disturbing the piping or headers. Tubes shall be silver brazed into the headers, and the length of tube between frame and header shall be sufficient to allow for inserting a copper sleeve joint in the event of coil replacement.

COIL SECTIONS shall be attached to the frame in a manner allowing side movement for header expansion. (If units are to be steam type, add the following sentence "Units having opposite end headers shall have expansion bends at the condensate end. Units having same end headers shall have special offset return bends to allow for expansion.")

HEADERS shall be electric welded steel pipe, and return headers (if steam is being used substitute "Condensate headers") shall be of the same size as the steam headers.

CONTROL DAMPERS shall have a diverting rather than baffling action so that at no time is a flat surface or pocket presented to the air stream. Blades shall be of extruded aluminum with heavy cross-section to prevent warping, and shall close against a fixed mullion, forming a labyrinth to minimize leakage of air, when the dampers are in closed position.

DOWN-STREAM DAMPERS shall be of extruded aluminum with hollow cross-section to provide a heat baffle, and shall be cross-linked to the control damper. Seals shall be as on control dampers.

ALL DAMPERS SHALL OPERATE IN NYLON BUSHINGS.

ALL DAMPERS, CONTROL AND DOWN-STREAM, are to be easily removable from the front or back of the unit without requiring any additional space at either end of the unit for withdrawing of damper shafts.

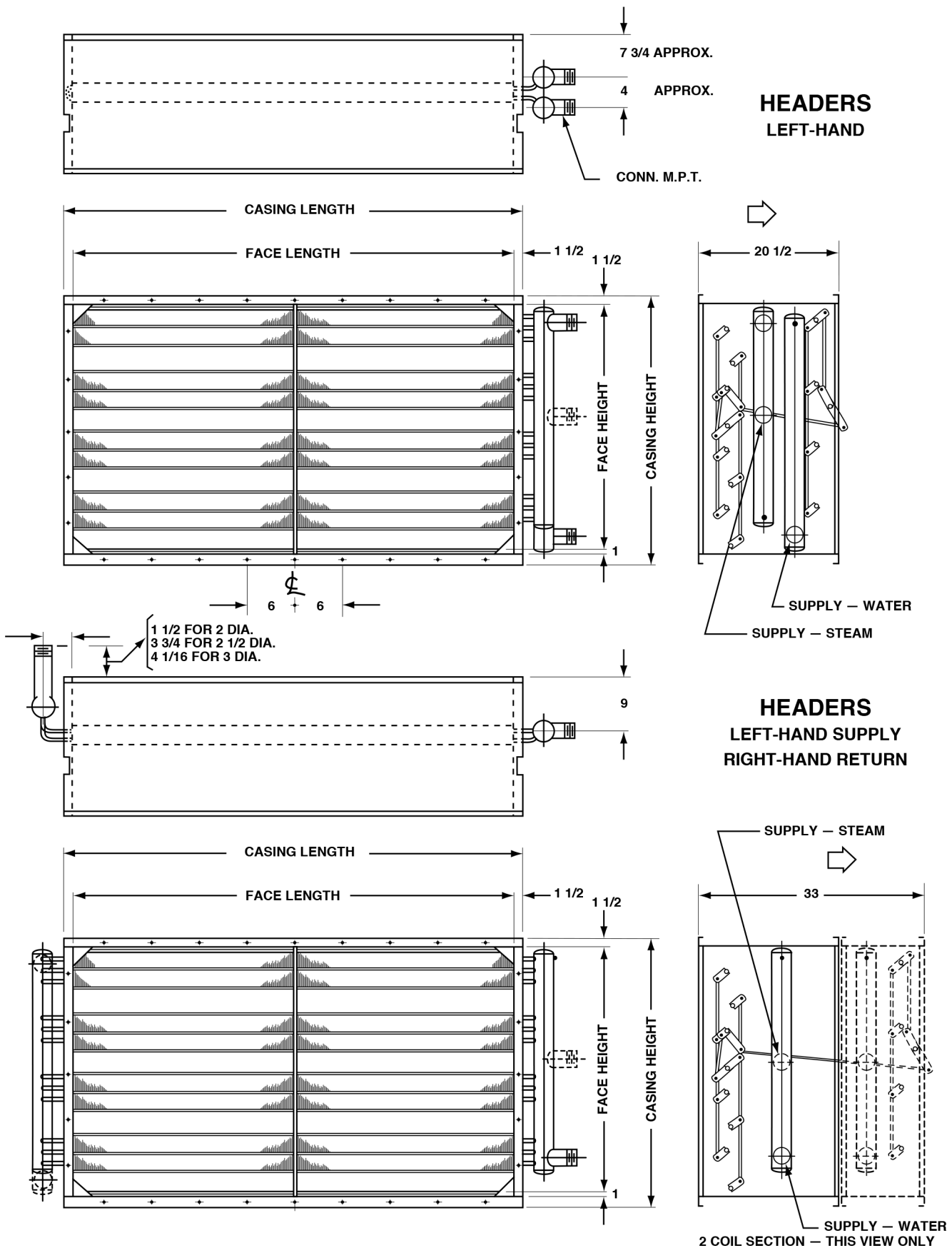
COIL SECTIONS SHALL BE FACTORY TESTED at 300 PSIG air pressure under water in an illuminated test tank.

DIMENSIONS, WEIGHT AND FACE AREA — MARK V HORIZONTAL TUBE LAMILINE UNITS

FACE HEIGHT	CASING HEIGHT	LENGTH IN INCHES																							
		FACE CASING	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116
			31	35	39	43	47	51	55	59	63	67	71	75	79	83	87	91	95	99	103	107	111	115	119
18	22	Area Sq. Ft.	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00	9.50	10.00	10.50	11.00	11.50	12.00	12.50	13.00	13.50	14.00	14.50
		Conn. MPT	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2
		Dry Weight	129	144	159	174	189	204	219	234	249	264	279	294	309	324	339	354	369	384	399	414	429	444	459
27	31	Area Sq. Ft.	5.25	6.00	6.75	7.50	8.25	9.00	9.75	10.50	11.25	12.00	12.75	13.50	14.25	15.00	15.75	16.50	17.25	18.00	18.75	19.50	20.25	21.00	21.75
		Conn. MPT	2	2	2	2	2	2	2	2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	
		Dry Weight	172	191	210	229	248	267	286	305	324	343	362	381	400	419	438	457	476	495	514	533	552	571	590
36	40	Area Sq. Ft.	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00
		Conn. MPT	2	2	2	2	2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	3	3	3	3	3	3	3	3	3
		Dry Weight	214	237	261	284	308	331	355	378	402	425	449	472	496	519	543	566	590	613	637	660	684	707	731
45	49	Area Sq. Ft.					13.75	15.00	16.25	17.50	18.75	20.00	21.25	22.50	23.75	25.00	26.25	27.50	28.75	30.00	31.25	32.50	33.75	35.00	36.25
		Conn. MPT					2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Dry Weight					368	396	424	452	479	507	535	563	591	618	646	674	702	730	757	785	813	841	869
54	58	Area Sq. Ft.							19.50	21.00	22.50	24.00	25.50	27.00	28.50	30.00	31.50	33.00	34.50	36.00	37.50	39.00	40.50	42.00	43.00
		Conn. MPT							3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		Dry Weight							493	525	558	590	622	654	686	719	751	783	815	847	880	912	944	976	1008
*63	67	Area Sq. Ft.								26.25	28.00	29.75	31.50	33.25	35.00	36.75	38.50	40.25	42.00	43.75	45.50	47.25	49.00	50.75	
		Conn. MPT									3	3	3	3	3	3	3	3	3	3	3	3	3	3	
		Dry Weight									639	676	712	749	785	822	858	895	931	968	1004	1041	1077	1114	1150
*72	76	Area Sq. Ft.										34.00	36.00	38.00	40.00	42.00	44.00	46.00	48.00	50.00	52.00	54.00	56.00	58.00	
		Conn. MPT											3	3	3	3	3	3	3	3	3	3	3	3	
		Dry Weight											794	835	876	916	957	998	1039	1080	1120	1161	1202	1243	1284

NOTES: 1. Increments of height are fixed. Increments of length may be interpolated as required.
2. Steam coils over 60" long should be single pass (Supply and Condensate at opposite ends).
3. Selections in shaded area should be avoided where possible for structural reasons.

* Supply header for LLS-H units in these heights is in two sections joined by a manifold.



TYPICAL SPECIFICATIONS FOR TYPE LLS-V (STEAM) LAMILINE UNITS

FACE AND BY-PASS COIL/DAMPER UNITS SHALL BE LAMILINE MARK V DESIGN, TYPE LLS-V.

These units shall consist of alternate vertical coil and bypass sections in a galvanized steel casing of not less than 14 gauge.

COIL SECTIONS shall be of copper tubes with aluminum fins, no less than 2 rows deep and not more than 6 inches wide. Each section shall be individually removable from the down-stream side of the unit without disturbing the piping or headers. Tubes shall be silver brazed into the headers, and the length of tube between frame and header shall be sufficient to allow for inserting a copper sleeve joint in the event of coil replacement.

COIL SECTIONS shall be attached to the frame in a manner allowing side movement for header expansion. Expansion bends shall be provided at the condensate header end.

HEADERS shall be electric welded steel pipe, and condensate headers shall be of the same size as the steam headers.

CONTROL DAMPERS shall have a diverting rather than baffling action so that at no time is a flat surface or pocket presented to the air stream. Blades shall be of extruded aluminum with heavy cross-section to prevent warping, and shall close against a fixed mullion, forming a labyrinth to minimize leakage of air when the dampers are in closed position.

DOWN-STREAM DAMPERS shall be of extruded aluminum with hollow cross-section to provide a heat baffle, and shall be cross-linked to the control damper. Seals shall be as on the control dampers.

ALL DAMPERS SHALL OPERATE IN NYLON BUSHINGS.

ALL DAMPERS, CONTROL AND DOWN-STREAM, are to be easily removable from the front or back of the unit without requiring any additional space above or below the unit for withdrawing of damper shafts.

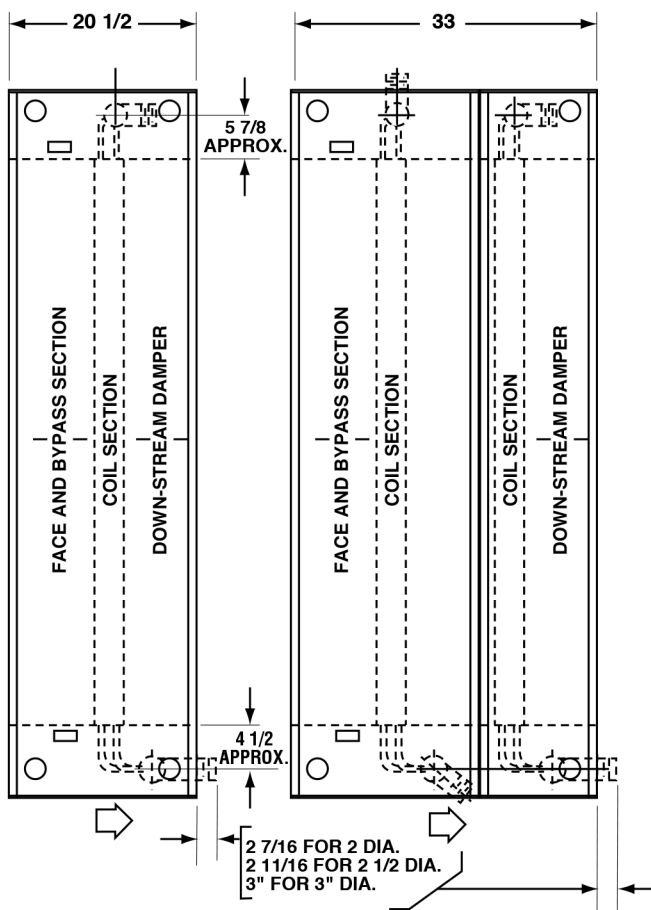
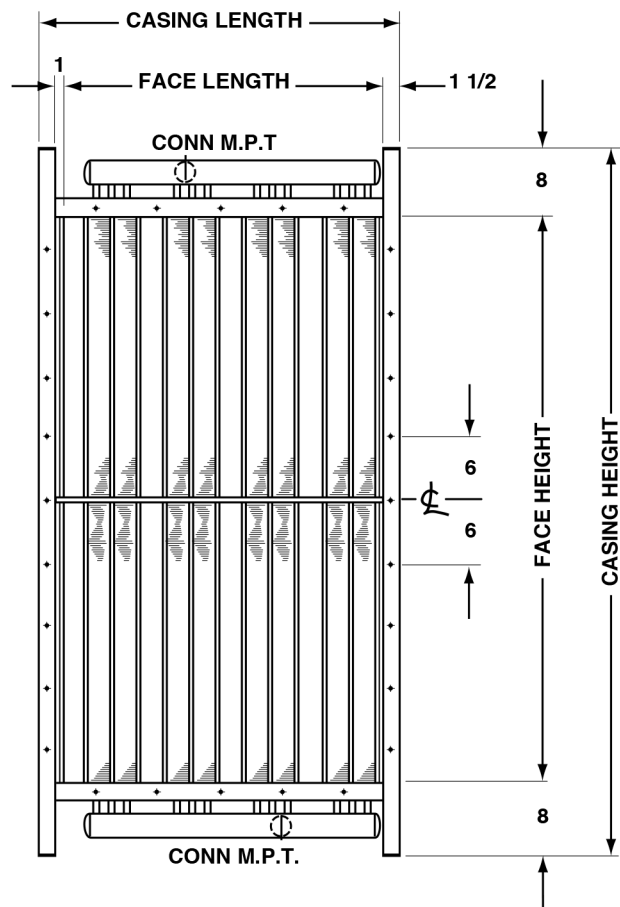
COIL SECTIONS SHALL BE FACTORY TESTED at 300 PSIG air pressure under water in an illuminated test tank.

DIMENSIONS, WEIGHT AND FACE AREA — MARK V VERTICAL TUBE LAMILINE UNITS

HEIGHT IN INCHES		LENGTH IN INCHES														
		FACE Casing 27 31			36 40			45 49			54 58			*63 67		
FACE	CAS-ING	FACE AREA	CONN. MPT	DRY WT.	FACE AREA	CONN. MPT	DRY WT.	FACE AREA	CONN. MPT	DRY WT.	FACE AREA	CONN. MPT	DRY WT.	FACE AREA	CONN. MPT	DRY WT.
28	44	5.25	2	172	7.00	2	214									
32	48	6.00	2	191	8.00	2	237									
36	52	6.75	2	210	9.00	2	261									
40	56	7.50	2	229	10.00	2	284	12.50	2 1/2	340						
44	60	8.25	2	248	11.00	2	308	13.75	2 1/2	368						
48	64	9.00	2	267	12.00	2 1/2	331	15.00	2 1/2	396	18.00	2 1/2	461			
52	68	9.75	2	286	13.00	2 1/2	355	16.25	2 1/2	424	19.50	3	493			
56	72	10.50	2	305	14.00	2 1/2	378	17.50	2 1/2	452	21.00	3	525			
60	76	11.25	2	324	15.00	2 1/2	402	18.75	2 1/2	479	22.50	3	558	26.25	3	639
64	80	12.00	2 1/2	343	16.00	2 1/2	425	20.00	3	507	24.00	3	590	28.00	3	676
68	84	12.75	2 1/2	362	17.00	2 1/2	449	21.25	3	535	25.50	3	622	29.75	3	712
72	88	13.50	2 1/2	381	18.00	2 1/2	472	22.50	3	563	27.00	3	654	31.50	3	749
76	92	14.25	2 1/2	400	19.00	2 1/2	496	23.75	3	591	28.50	3	686	33.25	3	785
80	96	15.00	2 1/2	419	20.00	2 1/2	519	25.00	3	618	30.00	3	719	35.00	3	822
84	100	15.75	2 1/2	438	21.00	3	543	26.25	3	646	31.50	3	751	36.75	3	858
88	104	16.50	2 1/2	457	22.00	3	566	27.50	3	674	33.00	3	783	38.50	3	895
92	108	17.25	2 1/2	476	23.00	3	590	28.75	3	702	34.50	3	815	40.25	3	931
96	112	18.00	2 1/2	495	24.00	3	613	30.00	3	730	36.00	3	847	42.00	3	968
100	116	18.75	2 1/2	514	25.00	3	637	31.25	3	757	37.50	3	880	43.75	3	1004
104	120	19.50	2 1/2	533	26.00	3	660	32.50	3	785	39.00	3	912	45.50	3	1041
108	124	20.25	2 1/2	552	27.00	3	684	33.75	3	813	40.50	3	944	47.25	3	1077
112	128	21.00	2 1/2	571	28.00	3	707	35.00	3	841	42.00	3	976	49.00	3	1114
116	132	21.75	2 1/2	590	29.00	3	731	36.25	3	869	43.50	3	1008	50.75	3	1150

NOTES: Increments of length are fixed. Increments of height may be interpolated as required.

* Supply header for these LLS-V units is in two sections joined by a manifold.



HEIGHT IN INCHES		LENGTH IN INCHES														
		FACE 72 Casing 76			81 85			90 94			99 103			108 112		
FACE	CASING	FACE AREA	CONN. MPT	DRY WT.	FACE AREA	CONN. MPT	DRY WT.	FACE AREA	CONN. MPT	DRY WT.	FACE AREA	CONN. MPT	DRY WT.	FACE AREA	CONN. MPT	DRY WT.
68	84	34.00	3	794	38.25	3	879	42.50	3	966	46.75	3	1051	51.00	3	1137
72	88	36.00	3	835	40.50	3	924	45.00	3	1016	49.50	3	1105	54.00	3	1195
76	92	38.00	3	876	42.75	3	969	47.50	3	1065	52.25	3	1158	57.00	3	1253
80	96	40.00	3	916	45.00	3	1014	50.00	3	1115	55.00	3	1212	60.00	3	1311
84	100	42.00	3	957	47.25	3	1059	52.50	3	1164	57.75	3	1266	63.00	3	1369
88	104	44.00	3	998	49.50	3	1104	55.00	3	1214	60.50	3	1320	66.00	3	1427
92	108	46.00	3	1039	51.75	3	1149	57.50	3	1263	63.25	3	1373	69.00	3	1485
96	112	48.00	3	1080	54.00	3	1194	60.00	3	1313	66.00	3	1427	72.00	3	1543
100	116	50.00	3	1120	56.25	3	1239	62.50	3	1362	68.75	3	1481	75.00	3	1601
104	120	52.00	3	1161	58.50	3	1284	65.00	3	1412	71.50	3	1534	78.00	3	1659
108	124	54.00	3	1202	60.75	3	1329	67.50	3	1461	74.25	3	1588	81.00	3	1717
112	128	56.00	3	1243	63.00	3	1374	70.00	3	1511	77.00	3	1642	84.00	3	1775
116	132	58.00	3	1284	65.25	3	1419	72.50	3	1560	79.75	3	1695	87.00	3	1833



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