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SINGLE-DUCT & RETROFIT TERMINAL UNITS

Installation, Operation & Maintenance Manual
for Krueger Terminal Units:
LMHS, LMHS-LC, RVE, SVE

KRUEGER®

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PRE-INSTALLATION

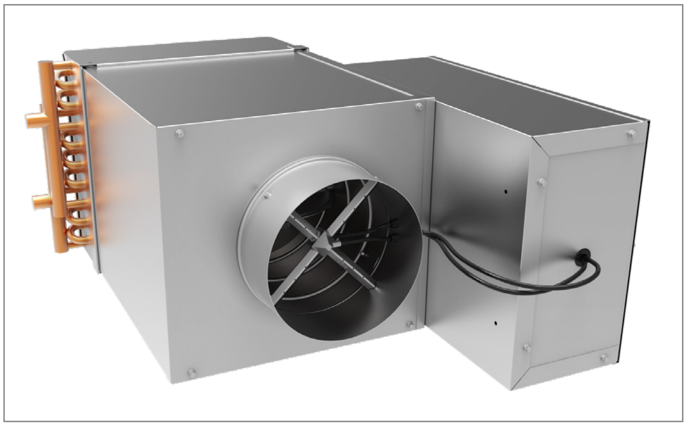


Figure 1: Basic LMHS Unit

GENERAL

The LMHS, LMHS-LC, RVE, and SVE single duct terminals are available with factory installed Pneumatic, Analog electronic, and DDC control options. Figure 1 shows a basic LMHS unit.

SHIPPING

Inspect for damage upon receipt. Shipping damage claims should be filed with shipper at time of delivery. LMHS and LMHS-LC units with basic configuration or with hot water coils, RVE units, and SVE units are packaged into boxes and are stacked onto pallets. LMHS and LMHS-LC units with attenuation or electric heat are stack directly onto pallets. In both instances, pallets shall not be stacked on top of one another.

STORAGE AND HANDLING

Store in a clean, dry, and covered location. Do not stack pallets. When unpacking units, care should be taken that the inlet collars and externally mounted components do not become damaged. Do not lift units using collars, inlet flow sensors, or externally mounted components as handles. Do not lay uncrated units on end or sides. Do not stack uncrated units over 6 ft high. Do not handle control boxes by tubing connections or other external attachments.

UNIT WEIGHTS

Please see Table 5.A and Table 5.B in Appendix A for unit weights.

INITIAL INSPECTION

Once items have been removed from the carton, check carefully for damage to duct connections, inlet probes or controls. File damage claim immediately with transportation agency and notify Factory.

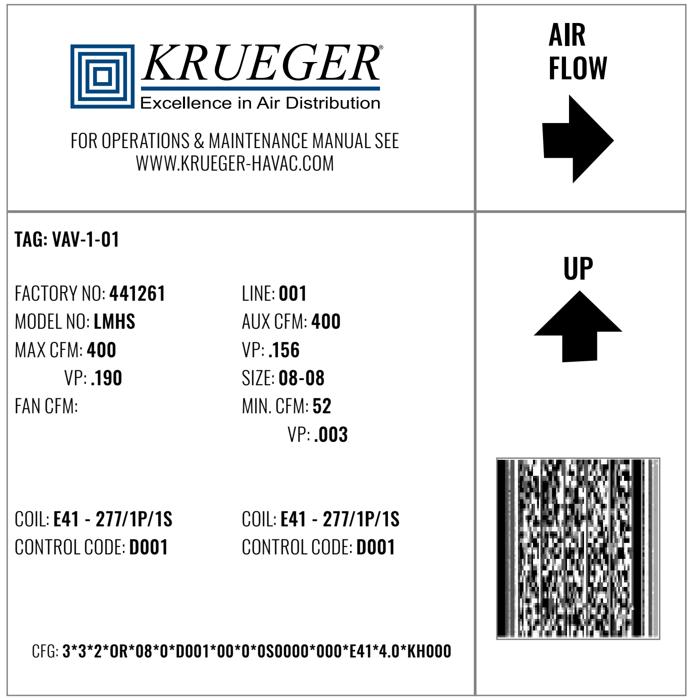


Figure 2: Example Identification Label

UNIT IDENTIFICATION

Each unit is supplied with a shipping label and an identification label. Figure 2 is an example of the identification label that is attached to each unit.

INSTALLATION PRECAUTION

Check that construction debris does not enter unit or ductwork. Do not operate the central-station air-handling fan without final or construction filters in place. Accumulated dust and construction debris distributed through the ductwork can adversely affect unit operation.

SERVICE ACCESS

Provide service clearance for unit access.

CODES

Install units in compliance with all applicable code requirements.

WARRANTY

All Krueger furnished items carry the standard 1-year limited warranty from the date of shipment.

MAINTENANCE

No periodic preventative maintenance required, unless called for by specific control sequence.

CONTROL ARRANGEMENTS

The LMHS / LMHS-LC single duct and RVE / SVE retrofit units are offered with a wide variety of factory-mounted controls that regulate the volume of air delivery from the unit and respond to cooling and heating load requirements of the conditioned space. Stand-alone controls will fulfill the thermal requirements of a given control space. These devices are available in both pneumatic and electronic arrangements. A number of DDC (Direct Digital Controls) control packages by others are available for consignment mounting, as indicated.

Each control approach offers a variety of operating functions; a control package number identifies combinations of control functions. The following listings contain the basic function arrangements for each control offering. Because of the variety of functions available, circuit diagrams, operating sequences, and function descriptions are contained in separate Application Data publications. Refer to the specific control publication for details.

Direct Digital Electronic Control Arrangement (Field Supplied)

Control packages are field supplied for factory mounting, unless otherwise noted. All DDC control arrangements include an inlet flow sensor, 24V transformer (optional), and control enclosure. Contact factory for details about mounting field-supplied controls.

Analog Electronic Control Arrangement

Pressure independent control packages are available without supplemental heat, with on/off hot water or electric heat, proportional hot water heat, or with cooling/heating automatic changeover control. All analog control arrangements include an inlet flow sensor, 24V transformer (optional), control enclosure, and wall thermostat with LCD display.

2100: Heating control
2101: Cooling control
2102: Cooling with on/off electric heat control
2103: Cooling with on/off hot water heat control
2104: Cooling/heating automatic changeover control
2105: Cooling with proportional hot water heat control
2110: Cooling with solid state LineaHeat proportional heat control
2111: Cooling/heating with automatic change over with up to 3 stages of electric heat control
2113: Cooling/heating with automatic change over with solid state LineaHeat proportional heat
2115: Upstream static pressure monitoring
2116: Downstream static pressure monitoring

Pneumatic Control Arrangement

All control packages are pressure independent (unless otherwise noted) and available with or without hot water heat, dual maximum airflow, heating and cooling maximum airflow and dual minimum airflow. All control arrangements include a standard K4 LineaCross inlet flow sensor.

1100 (Actuator only): DA-NC Pressure dependent control
1101 (Actuator only): RA-NO Pressure dependent control
1102 (Single function controller): DA-NO with or without hot water or electric heat
1103 (Single function controller): RA-NC with or without hot water or electric heat
1104 (Multi-function controller): DA-NO with or without hot water or electric heat
1105 (Multi-function controller): DA-NC with or without hot water or electric heat
1106 (Multi-function controller): RA-NO with or without hot water or electric heat
1107 (Multi-function controller): RA-NC with or without hot water or electric heat
1108 (Dual Maximum Control): DA-NO with or without hot water or electric heat
1109 (Heating/Cooling Maximum Control): DA-NO with or without hot water or electric heat
1110 (Dual Minimum Control): DA-NO with or without hot water or electric heat
1111 (Dual Minimum Control): RA-NO with or without hot water or electric heat
1112 (Heating/Cooling Maximum Control): RA-DO with or without hot water or electric heat

Pneumatic Control Legend

- DA: Direct acting thermostat
- RA: Reverse acting thermostat
- NO: Normally open damper position
- NC: Normally closed damper position
- Single function controller: Provides single function, i.e., DA-NO
- Multi-function controller: Capable of providing DA-NO, DA-NC, RA-NC or RA-NO functions.

No Control Arrangement

- 0000: Unit with no control box.
- D000: Unit with control enclosure and transformer.
- D001: Unit with control enclosure and no transformer. Also used for control enclosure and electric heat.

INSTALLATION

STEP 1 - INSTALL UNIT

A. Move unit to installation area. Remove unit from shipping package. Do not handle by controls, flow sensors or damper extension rod.

B. Optionally, the unit may have factory-installed hanger brackets.

C. Suspend units from building structure with field supplied straps, rods, or hanger wires. Secure the unit and level it in each direction. Krueger LMHS units with electric heat must be mounted in the horizontal position, where airflow runs parallel to the ground.

D. Figure 3 illustrates the use of optional factory installed hanger brackets for suspending units.

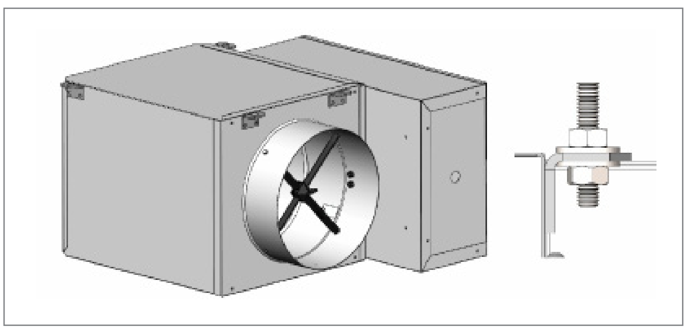


Figure 3: Factory Installed Hanger Brackets (field supplied rod and nuts).

STEP 2 – MAKE DUCT CONNECTIONS

A. Install supply ductwork on each of the unit inlet collars. It is recommended that a length of straight duct equal to 3 times the diameter of the duct is supplied to the inlet of the unit. An elbow put at the inlet of the unit will create turbulence at the inlet making it difficult for the flow sensor to accurately measure the airflow. Check that air-supply duct connections are airtight and follow all accepted medium-pressure duct installation procedures. Refer to Table 6.A – LMHS, 6.B – LMHS-LC, 6.C – RVE, and 6.D - SVE for pressure and flow data.

B. Install the discharge ducts. Fully open all balancing dampers.

STEP 3 - INSTALL SENSORS AND MAKE FIELD WIRING CONNECTIONS

A. Refer to specific unit dimensional submittals and control application diagrams for control specifications. All field wiring must comply with National Electrical Code (NEC) and local requirements. Refer to the wiring diagram on the unit for specific wiring connections. A field-supplied transformer is required if the unit was not equipped with a factory installed transformer. See Figure 4 for illustration.

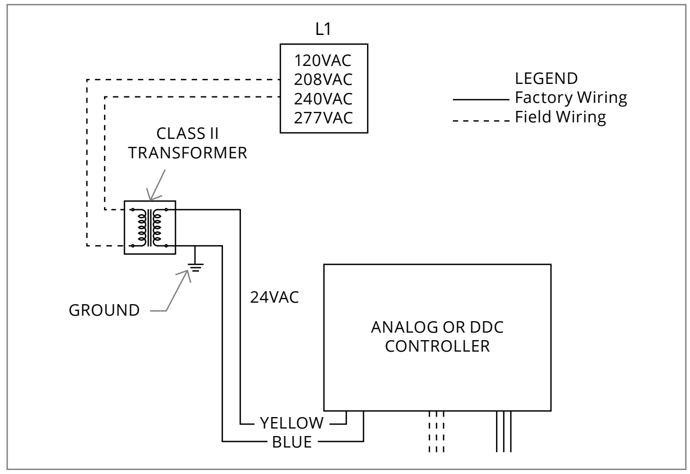


Figure 4: Wiring of Optional Factory Mounted Transformer

NOTE: Refer to wiring diagram attached to each unit for specific information on that particular unit.

Single duct terminal units with electric heat are supplied with a single point wiring connection in the heater control box. All unit power is supplied through this connection. Models with electric heat are factory equipped with a control transformer. Figure 5 illustrates an example high voltage wiring diagram that includes a unit with electric heat.

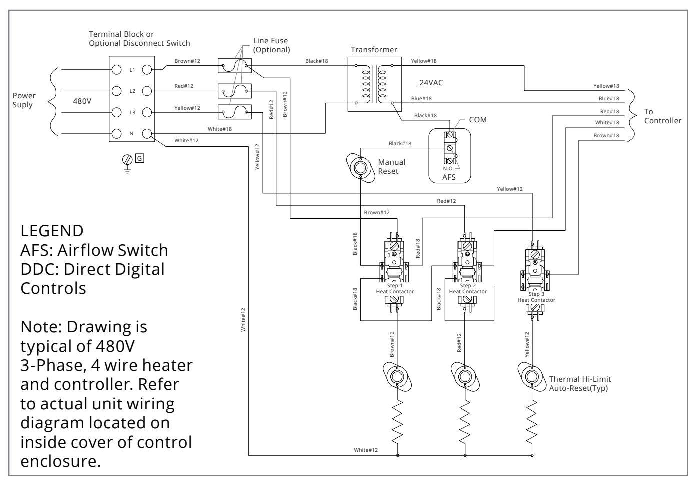


Figure 5: Typical Power Connections for LMHS units with 3-Stage Electric Heat. Wiring and unit ampacities are referenced in Table 7.

NOTE: Refer to wiring diagram attached to each unit for specific information on that particular unit. Units with 480-3-60 electric heater REQUIRE 4-wire, wye connected power. Units with 208/230v, 3-phase heater can be connected with 3-wire power. Unit airflow should not be set outside of the range noted in Figure 6. The minimum recommended airflow for units with electric heat must be at least 75 cfm per kW and not drop below the minimum values listed in Table 6.A. The maximum unit discharge temperature should not exceed 120°F. To prevent air stratification, the ASHREA Handbook of Fundamentals recommends a discharge temperature not to exceed 90°F.

CONTROLS SETUP

GENERAL

The LMHS / LMHS-LC single duct VAV terminal is designed to supply a varying quantity of cold primary air to a space in response to a thermostat demand. Some units have reheat options to provide heating demand requirements as well. Most VAV terminals are equipped with pressure compensating controls to regulate the response to the thermostat independent of the pressure in the supply ductwork. To balance the unit it is necessary to set both the maximum and minimum set points of the controller. The many types of control options available each have specific procedures required for balancing the unit.

SET POINTS

Maximum and minimum airflow set points are normally specified for the job and specific for each unit on the job. Where maximum and minimum airflow levels are not specified on the order, default values are noted on unit ID label.

FIELD ADJUSTMENT OF MINIMUM AND MAXIMUM AIRFLOW SET POINTS

Each unit is equipped with an amplifying inlet airflow sensor that measures a differential pressure proportional to the airflow. The relationship between the inlet airflow pressures and cfm is shown in the Figure 6 – Krueger Inlet Airflow Sensor Chart. This chart is attached to each unit.

The controls on most new projects are Direct Digital (DDC) Controls. These controls require that flow parameters be loaded during start-up to translate the sensed pressure into a measured flow rate. There are several conventions (and no universally accepted method) in use for representing this flow factor:

1. Magnification Factor - The magnification factor may be expressed as the ratio of either velocity or pressure, of the output of the sensor to that of a pitot tube.
    b. For example, a velocity magnification may be used. All Krueger probes develop an average signal of 1 w.g. @2625 fpm. This gives a velocity magnification of 4005/2625, or 1.52.
    c. The magnification factor may be a pressure factor. In this case, the ratio of pressures at a given air velocity is presented. For a velocity constant of 2626, at 1000 fpm, this is 0.1451 / 0.0623 = 2.33.
4. K-Factor: The 'K-factor' may be represented in two ways
    a. It may be a velocity K-factor, which is the velocity factor independent of the inlet area, (which for all Krueger inlet airflow sensors, both Linear and the new LineaCross, is 2625 fpm/in w.g.).
    b. Alternatively, it may be the airflow K-Factor, which is the velocity factor times the inlet area. For an 8 inch Krueger unit, therefore, this would be 2625 * 0.349, or 916. A separate factor is required for each size. Below is a K-Factor table for all Krueger VAV terminal inlets.
    c. $CFM=K\sqrt{\Delta P}$
        i. CFM=ft^3/minute
        ii. ΔP= Pressure Differential (WG)
        iii. K=Sensor Constant

TABLE 1: INLET AIRFLOW SENSOR AREA AND K FACTOR

LMHS, RVE	04	05	06	07	08	09	10	12	14	16	22
Inlet Diameter, in.	4	5	6	7	8	9	10	12	14	16	22
Velocity Magnification	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52
Velocity Factor	2625	2625	2625	2625	2625	2625	2625	2625	2625	2625	2625
CFM K Factor	229	358	515	702	916	1160	1432	2062	2806	3665	7000
Inlet Area, Sq. ft.	0.087	0.136	0.196	0.267	0.349	0.442	0.545	0.785	1.069	1.396	2.667
Recommended Min CFM (@ 0.03 WG)	40	62	89	122	159	201	248	357	486	635	1212

SYSTEM CALIBRATION OF AIRFLOW SENSOR

To achieve accurate pressure independent operation, the inlet airflow sensor must be calibrated to the controller. This will ensure that airflow measurements will be accurate for all terminals at system start-up. System calibration is accomplished by calculating a flow coefficient that adjusts the pressure fpm characteristics. The flow coefficient is determined by dividing the flow for a given unit (design air volume in cfm), at a pressure of 1.0 in. w.g differential pressure, by the standard Pitot tube coefficient of 4005.This ratio is the same for all sizes, no matter which probe type is installed. Determine the design air velocity by dividing the design air volume (the flow at 1.0 in. w.g) by the nominal inlet area (sq. ft). This factor is the CFM K factor, list in the Table 1 above.

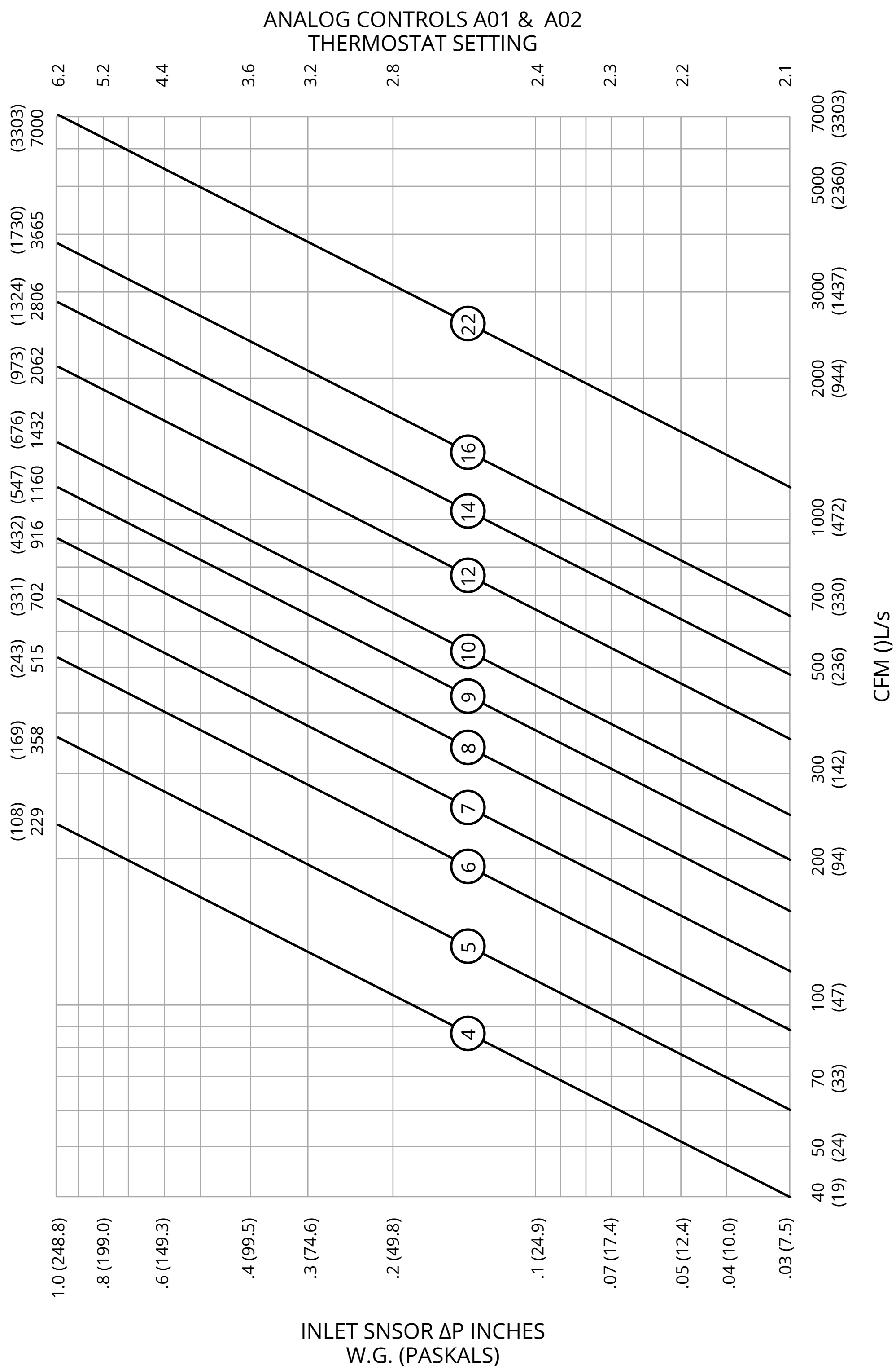


Figure 6 - Krueger Inlet Airflow Sensor Chart

PNEUMATIC CONTROLS

Volume controllers for LMHS units are shown below. Identification for each controller is shown in the following table.

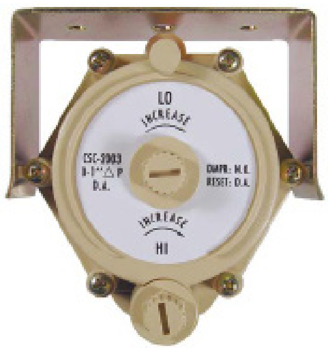
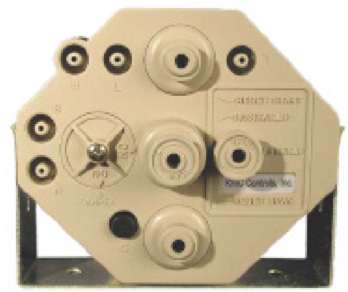
PNEUMATIC VOLUME CONTROLLERS		
		
KMC - CSC 2003 (Normally Open)	KMC - CSC 2004 (Normally Closed) *LO and HI are reversed*	KMC - CSC 3011 (Multi Function Controller)

Figure 7: Pneumatic Volume Controllers

TABLE 2: PNEUMATIC CONTROL SEQUENCE CONTROLLERS		
CONTROL SEQUENCE	FUNCTION ARRANGEMENT	KMC PART NUMBER
1102	DA-NO	CSC-2003
1103	RA-NC	CSC-2004
1104	DA-NO	CSC-3011
1105	DA-NC	CSC-3011
1106	RA-NO	CSC-3011
1107	RA-NC	CSC-3011
1108	DA-NO, DUAL MAXIMUM	CSC-3011
1109	DA-NO, HEATING/COOLING MAXIMUM	CSC-3011 (2X)
1110	DA-NO, DUAL MINIMUM	CSC-3011
1111	RA-NO, DUAL MINIMUM	CSC-3011
1112	RA-NO, HEATING/COOLING MAXIMUM	CSC-3011 (2X)
LEGEND: DA - DIRECT ACTING, NC - NORMALLY CLOSED, NO - NORMALLY OPEN, RA - REVERSE ACTING		

PREPARATION FOR BALANCING (CONTROL SEQUENCES 1102 AND 1103)

1. Inspect all pneumatic connections to assure tight fit and proper location.
2. Verify that the thermostat being used is compatible with the control sequence provided (direct acting or reverse acting).
3. Check main air pressure at the controller(s). The main air pressure must be between 15 psi and 25 psi. (If dual or switched-main air pressure is used, check the pressure at both high and low settings.) The difference between high pressure main and low pressure main should be at least 4 psi, unless otherwise noted, and the low setting difference should exceed 15 psi.
4. Check that the unit damper will fail to the proper position when main air pressure is lost. Disconnect the pneumatic actuator line from the velocity controller and observe the VAV damper position. The damper should fail to either a normally open position (indicator mark on shaft end is horizontal) or a normally closed position (indicator mark on shaft end is vertical).
5. Check that there is primary airflow in the inlet duct.
6. Connect a Magnehelic gage, inclined manometer or other differential pressure measuring device to the balancing taps provided in the velocity probe sensor lines. The manometer should have a full scale reading of 0.0 to 1.0 in. wg. The high-pressure signal is delivered from

the front sensor tap (away from the valve), and the low pressure signal is delivered from the back line (near the valve). The pressure differential between high and low represents the amplified velocity pressure in the inlet duct.

7. Read the differential pressure and enter the Krueger Inlet Airflow Sensor Chart (Figure 6) to determine the airflow in the terminal unit. For example, a differential pressure of 0.10 in. wg for a size 8 unit yields an airflow of 290 cfm.

BALANCING PROCEDURE
(CONTROL SEQUENCES 1102 AND 1103)

Direct Acting Thermostat:
Normally Open Damper (Control Sequence 1102)

1. Minimum Volume Setting:
   b. Disconnect the thermostat line from the volume controller.
   c. Adjust the minimum volume control knob (marked LO and located in the center of the controller) to achieve the required minimum flow. To determine the required pressure differential, refer to Table 1, Table 2, and the Krueger Inlet Airflow Sensor Chart that is provided on the side of the VAV unit and in Figure 6.
   d. Reconnect the thermostat line.
2. Maximum Volume Setting:
   c. Disconnect the thermostat line from the volume controller.
   d. Apply 15 + psi to the thermostat port on the volume controller (marked "T") by tapping into the main air pressure line.
   e. Adjust the maximum volume control knob (marked HI and located at the side of the controller) until the desired pressure differential is registered on the manometer. To determine the required pressure differential, refer to Table 1, Table 2, and the Krueger Inlet Airflow Sensor Chart that is provided on the side of the VAV unit and in Figure 6.
   f. Reconnect the thermostat line.

Reverse Acting Thermostat:
Normally Closed Damper (Control Sequence 1103)

1. Maximum Volume Setting:
   b. Disconnect the thermostat line from the velocity controller.
   c. Adjust the maximum volume control knob (marked HI and located in the center of the controller) to achieve the required minimum flow. To determine the required pressure differential, refer to Table 1, Table 2, and the Krueger Inlet Airflow Sensor Chart that is provided on the side of the VAV unit and in Figure 6.
   d. Reconnect the thermostat line.
2. Minimum Volume Setting:
   c. Disconnect the thermostat line from the velocity controller.
   d. Apply 15 + psi to the thermostat port on the volume controller (marked "T") by tapping into the main air pressure line.
   e. Adjust the minimum volume control knob (marked LO and located at the side of the controller) until the desired pressure differential is registered on the manometer. To determine the required pressure differential, refer to Table 1, Table 2, and the Krueger Inlet Airflow Sensor Chart that is provided on the side of the VAV unit and in Figure 6.
   f. Reconnect the thermostat line.

BALANCING PROCEDURE
(CONTROL SEQUENCES 1104-1110)

1. Damper action is factory set at N.O. (normally open), or N.C. (normally closed). To change perform the following steps:
   b. Loosen the damper selection screw.
   c. Turn the selection dial clockwise until the NC or NO arrow aligns with the DAMPER arrow.

   NOTE: Accuracy in the alignment of the arrows is very important. Make this adjustment as exact as possible. (See Figure 8)
4. Pipe the controller: Connect port "B" to the damper actuator. Connect port "M" to the clean, dry main air. Connect port "T" to the thermostat output. Connect port "H" to the total pressure tap on the airflow sensor. Connect port "L" to the static pressure tap on the airflow sensor. The controller can be set up for cooling or heating applications using either a Direct Acting (DA) or Reverse Acting (RA) thermostat signal. The two flow adjustments are labeled LO STAT ΔP and HI STAT ΔP.

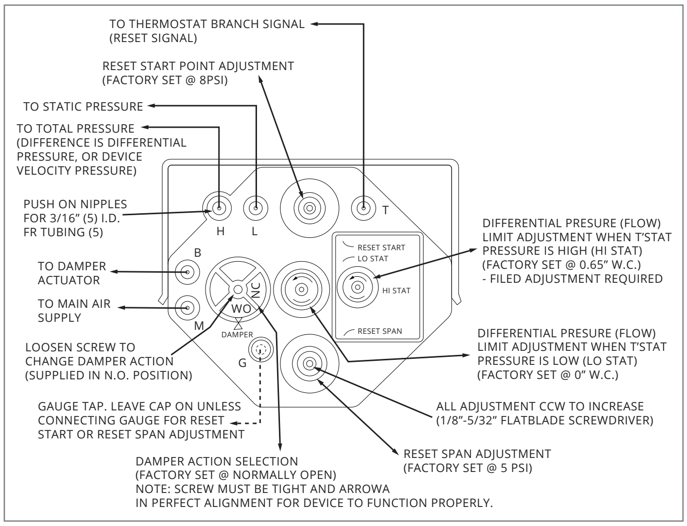


Figure 8 – CSC 3011

Adjusting Minimums and Maximums

- When adjusting the minimum and maximum airflow settings, the output responds slowly to changes in the set point. Wait for the flow rate to stabilize after making an adjustment (usually 20 to 30 seconds) before making further adjustments. Also, if the damper position is all the way closed or open when starting this step, turn the adjustment one full turn, and then wait 20 to 30 seconds for a change in the flow reading of the Magnehelic gauge. If no change occurs after this time, repeat until the flow rate changes.

LO STAT ΔP Setting

is the desired airflow limit when the thermostat pressure is less than, or equal to, the reset start point.

- For DA Cooling or RA Heating: Adjust LO STAT ΔP to the desired minimum airflow with 0 psig (or a pressure less than the reset start point) at port "T". The LO STAT ΔP must be set first. The LO STAT ΔP will affect the HI STAT ΔP setting. (Turn Clockwise)
- For RA Cooling or DA Heating: Adjust LO STAT ΔP to the desired maximum airflow with 0 psig (or a pressure less than the reset start point) at port "T". The LO STAT ΔP must be set first. The LO STAT ΔP will affect the HI STAT ΔP setting. (Turn Counter Clockwise)

HI STAT ΔP Setting

is the desired airflow limit when the thermostat pressure is greater than, or equal to, the reset stop-point. The reset stop-point is the reset span pressure added to the reset start point pressure.

- For DA Cooling or RA Heating (See Figure 7): Adjust HI STAT ΔP to the desired maximum airflow with 20 psig (or a pressure greater than the reset stop point) at port "T". The HI STAT ΔP must be set last. The HI STAT ΔP setting will be affected by the LO STAT ΔP setting. (Turn Counter Clockwise)
- For RA Cooling or DA Heating (See Figure 7): Adjust HI STAT ΔP to the desired minimum airflow with 20 psig (or a pressure greater than the reset stop point) at port "T". The HI STAT ΔP must be set last. The HI STAT ΔP setting will be affected by the LO STAT ΔP setting. (Turn Clockwise)

NOTES:

- If the LO STAT ΔP Limit must be set at 0 (zero minimum), do not turn the LO STAT ΔP knob fully clockwise. The knob will adjust one and one-half turns after a zero minimum is reached. Turning the LO STAT ΔP knob fully clockwise will result in a negative reset condition. This means that when the controller begins to reset at the reset start point, it must first overcome the negative adjustment and will not begin to reset from 0 until a higher thermostat reset pressure is reached. This negative reset will also reduce the effective range of the controller by reducing the low end reset, narrowing the reset span. If a zero minimum is required, adjust the LO STAT ΔP knob until the controller just begins to crack the damper open, and then back-off one-quarter turn and verify zero airflow. (This is typically 2-1/2 knob rotations counter clockwise from the fully clockwise position.)
- After the LO STAT ΔP and HI STAT ΔP initial adjustments are made, cycle the thermostat pressure a few times to settle the internal reset mechanisms and verify settings. Fine-tune the settings if necessary. The thermostat pressure may be left at a high pressure and the "G" port cap may be removed and replaced to cycle the reset mechanism.

RESET START Setting

is factory set at 8.0 psig. This is the lowest thermostat pressure that the LO STAT ΔP airflow will begin to reset towards the HI STAT ΔP airflow. To change the RESET START setting; regulate thermostat pressure to the "T" port to the desired reset start point pressure, adjust RESET START adjustment until pressure at the "G" port is slightly higher than 0 psig, i.e., 0.1 psig.

NOTE:

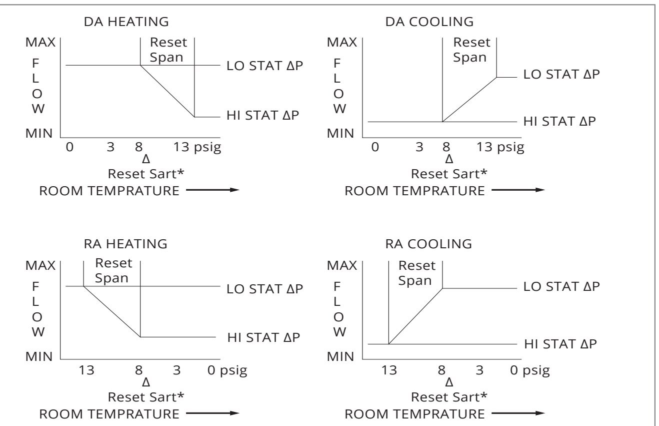
- For Dual Duct Units the Reset Start Must To Be Adjusted To 3.0 Psig. ON THE HEATING SIDE ONLY.
- The "G" port taps into the controller's internal reset chamber, which always starts at 0 psig. The RESET START adjustment is a positive bias adjustment that sets the desired thermostat start point to the controller's internal reset start point of 0 psig.

RESET SPAN Setting

is factory set at 5.0 psig. This is the required change in thermostat pressure that the controller will reset between the LO STAT ΔP setting and the HI STAT ΔP setting. To change the RESET SPAN setting; adjust RESET SPAN adjustment until pressure at the "G" port equals the desired reset span pressure. **(Do Not Adjust)**

NOTE:

- The "G" port taps into the controller's internal reset chamber, which will always be at a pressure between 0 psig and the RESET SPAN pressure.



*May require changing the RESET START from 8.0 to 3.0 psig if sequencing is involved.

Figure 9 – Reset Cycle for CSC 3011 Control

PREVENTATIVE MAINTENANCE

1. Inspect pneumatic tubing for loose connections or leaks.
2. Clean out pneumatic line filters regularly according to manufacturer's recommendations.

TABLE 3: PNEUMATIC CONTROL TROUBLESHOOTING	
PROBLEM	**PROBABLE CAUSE**
Controller does not reset to maximum or minimum set point during balance procedure	Balancer is using the thermostat for control signal. An artificial signal must be provided in place of the thermostat.
Controller does not reset to maximum or minimum set point during operation.	Thermostat is not demanding maximum or minimum air volume. Main air pressure at the controller is less than 15 psi.
Pneumatic actuator does not stroke fully.	Leak in pneumatic line between the controller and the actuator.Main air pressure at the controller is less than 15 psi. Leak in the diaphragm.
Air valve stays in wide open position.	Inlet airflow sensor is blocked by an obstruction (sandwich bag, etc.). Insufficient supply air in the inlet duct.
NOTE: Always check:	
• Main air pressure (15 psi to 25 psi) at the controller.	• Proper thermostat signal and logic (Direct/Reverse Acting).
• Disconnected or kinked pneumatic lines to the controller	• Blocked inlet airflow sensor or insufficient primary supply air.
• Quality of compressed air (oil or water in lines).	• Leaks in the actuator diaphragm.
• Mechanical linkage of the actuator/air valve.	

ANALOG CONTROLS

INSTALLATION AND BALANCING PROCEDURES

The Analog Electronic Control System is a pressure independent volume reset control that uses a KMC CSP-4702 controller-actuator (see Figure 10).

Adjustments for the minimum and maximum airflow settings are made at the thermostat. The thermostat (CTE-5202) operates on a 16 VDC power supply from the CSP 4702 controller and outputs a 0 to 10 VDC signal on the AO1 and AO2 terminals. AO1 is used as the cooling output and AO2 is used as the heating output.

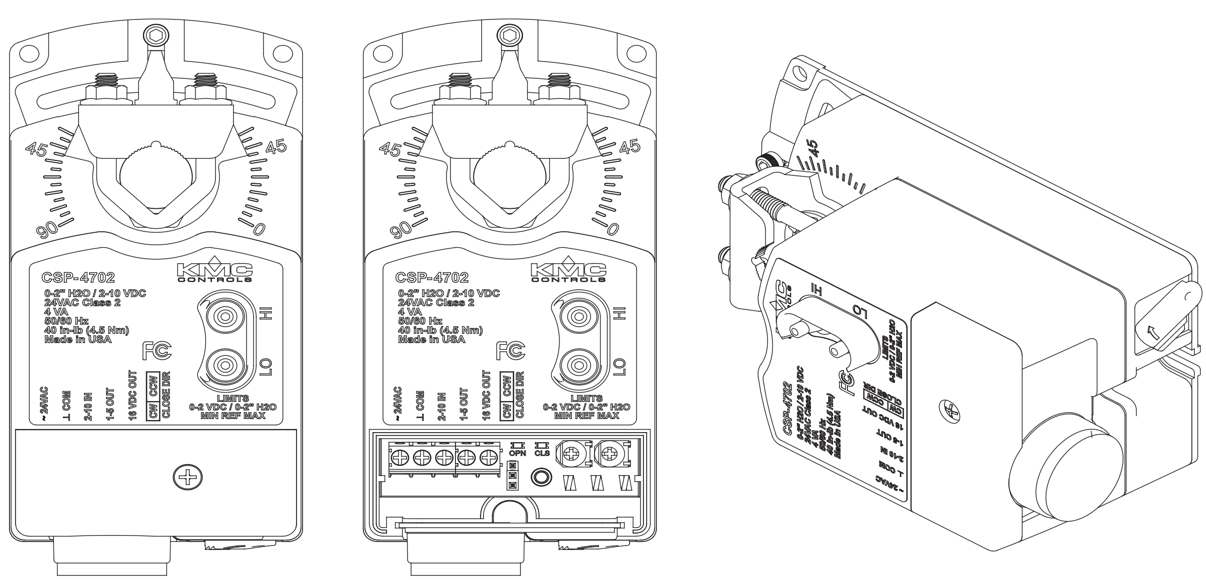


Figure 10 – Analog Controller CSP 4702

THERMOSTAT INSTALLATION

For proper operation, mount the thermostat on an interior wall. Do not mount the thermostat in a location that will cause it to be affected by direct sunlight or other heat or cold sources. The thermostat should be clear of all obstructions so it can properly sense the room temperature. Complete rough-in wiring at each location prior to thermostat installation. Cable insulation must meet local building codes.

1. Remove thermostat cover. If the thermostat is locked on the back plate, turn the two hex screws in on the bottom of the cover (in the two outermost holes) in the back plate CLOCKWISE until they clear the cover. Do not remove these screws completely. Swing the thermostat up and away from the back plate to remove it.
2. Route the wires through the opening in the back plate.
3. Install the back plate directly to the junction box using the screws supplied with the thermostat. Verify the hex screws used for securing the cover are located at the bottom before installing.
4. Connect the wires to the terminal block. Refer to the wiring diagram located on the inside cover of the control enclosure of each unit showing the wiring terminations. The wiring schematic can also be found on the control sequence submittal found on the Krueger website.
5. Replace the thermostat cover. Turn the two hex screws COUNTER CLOCKWISE until they are flush with the bottom cover and secure it to the back plate.

PROGRAMMING THERMOSTAT

1. The thermostat has three sequences that are selectable from the display screen. To access the configuration menu on the thermostat, press and hold the Up and Down arrows for 10 seconds until the display starts flashing LIMITS. Use the Up and Down arrows to scroll between the different menu options or set a specific value. Use the Setpoint button to select a menu or set a value.
2. To set the minimum and maximum airflow limits, Use AO1 Min and AO1 Max or AO2 Min and AO2 Max. Use the Table 4 below to determine thermostat setting for the CFM per inlet size.
3. For details on how to program the thermostat for each control sequence see the specific control sequence submittal. The control sequence submittals can be at the Krueger Website: www.krueger-hvac.com.

NOTE: Default Settings are as follows:

- AO1 – MIN=0, MAX=12, AUX=0
- AO2 – MIN=0, MAX=12
- DEAD BD (deadband) = 2° F
- SETBACK (standby/unoccupied setback) = 2° F
- PROP BD (loop proportional band) = 2° F
- Rm OFST (room temperature offset) = 0
- CNG OVR (changeover temperature) = 77° F
- ITIME (loop integral time) = 30 minutes

TABLE 4: SETTING MIN AND MAX VALUES ON THERMOSTAT													
A01 & A02 SETTING	SENSOR SIGNAL W.G.	CFM PER INLET SIZE											
		4	5	6	7	8	9	10	12	14	16	20	22
0-2	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2.1	0.03	36	57	81	111	145	183	226	326	444	580	315	1107
2.2	0.05	51	80	115	157	205	259	320	461	627	820	445	1565
2.3	0.08	63	98	141	192	251	318	392	565	768	1004	545	1917
2.4	0.10	72	113	163	222	290	367	453	652	887	1159	630	2214
2.5	0.13	81	127	182	248	324	410	506	729	992	1296	704	2475
2.6	0.15	89	139	200	272	355	449	555	798	1087	1420	771	2711
2.7	0.18	96	150	216	293	383	485	599	862	1174	1533	833	2928
2.8	0.20	102	160	231	314	410	519	640	922	1255	1639	891	3130
2.9	0.23	109	170	244	333	435	550	679	978	1331	1739	945	3320
3.0	0.25	115	179	258	351	458	580	716	1031	1403	1833	996	3500
3.1	0.28	120	188	270	368	481	608	751	1081	1472	1922	1045	3671
3.2	0.30	125	196	282	384	502	635	784	1129	1537	2008	1091	3834
3.3	0.33	131	204	294	400	522	661	816	1175	1600	2089	1136	3991
3.4	0.35	136	212	305	415	542	686	847	1220	1660	2168	1178	4141
3.5	0.38	140	219	316	430	561	710	877	1263	1718	2244	1220	4287
3.6	0.40	145	226	326	444	580	733	905	1304	1775	2318	1260	4427
3.7	0.43	149	233	336	457	597	756	933	1344	1829	2389	1299	4563
3.8	0.45	154	240	346	471	615	778	960	1383	1882	2459	1336	4696
3.9	0.48	158	247	355	484	632	799	987	1421	1934	2526	1373	4824
4.0	0.50	162	253	364	496	648	820	1012	1458	1984	2592	1408	4950
4.1	0.53	166	259	373	508	664	840	1037	1494	2033	2656	1443	5072
4.2	0.55	170	265	382	520	680	860	1062	1529	2081	2718	1477	5191
4.3	0.58	174	271	391	532	695	879	1086	1563	2128	2779	1510	5308
4.4	0.60	177	277	399	543	710	898	1109	1597	2174	2839	1543	5422
4.5	0.63	181	283	407	555	724	917	1132	1630	2218	2898	1575	5534
4.6	0.65	185	289	416	566	739	935	1154	1662	2262	2955	1606	5644
4.7	0.68	188	294	423	576	753	953	1176	1694	2305	3011	1636	5751
4.8	0.70	192	299	431	587	767	970	1198	1725	2348	3067	1666	5857
4.9	0.73	195	305	439	597	780	987	1219	1755	2389	3121	1696	5960
5.0	0.75	198	310	446	608	794	1004	1240	1785	2430	3174	1725	6062
5.1	0.78	202	315	454	618	807	1021	1260	1815	2470	3227	1753	6162
5.2	0.80	205	320	461	627	820	1037	1281	1844	2510	3278	1782	6261
5.3	0.83	208	325	468	637	832	1053	1300	1873	2549	3329	1809	6358
5.4	0.85	211	330	475	647	845	1069	1320	1901	2587	3379	1836	6454
5.5	0.88	214	335	482	656	857	1085	1339	1929	2625	3428	1863	6548
5.6	0.90	217	340	489	666	869	1100	1358	1956	2662	3477	1890	6641
5.7	0.93	220	344	496	675	881	1115	1377	1983	2699	3525	1916	6732
5.8	0.95	223	349	502	684	893	1130	1395	2009	2735	3572	1941	6823
5.9	0.98	226	353	509	693	905	1145	1414	2036	2771	3619	1967	6912
6.0	1.00	229	358	515	702	916	1160	1432	2062	2806	3665	1992	7000

ANALOG CONTROL TROUBLESHOOTING

The following troubleshooting guide is directed towards single duct cooling applications, the same concepts can be applied to other configurations.

NOTE: For about 15 seconds after power is applied, no rotation occurs and one or both of the controller/actuator LEDs will flash.

Controller

1. Check that the shaft moves freely. (Press and hold the actuator release clutch and manually rotate the shaft.)
2. Check wiring. (See Wiring Issues section below.)
3. Check for a tripped circuit breaker to the transformer, for proper supply voltage from the transformer (or power supply), and for enough capacity (VA) for all connected devices.
4. Check that the direction jumper is in the proper position per individual controls submittal.
5. Check the polarity and level of the input signal from the thermostat.

Wrong Rotation Direction or Stroke Range

1. Check the position of the direction jumper.
2. Check the Min and Max flow limits on the thermostat (AO1 / AO2).
3. Check the adjustable mechanical stop position.

No Pressure Output Signal from Inlet Sensor

1. Check the tubing. Tubing should be free of kinks and restrictions.
2. Check air flow and sensor. Sensor must be oriented in the correct airflow direction and free of large debris.

Wiring Issues

1. Check for correct wiring at unit and thermostat per individual controls submittal.
2. At the Controller, verify 24 VAC at terminals "~" (phase) and "-" (ground). Tolerance can be –15% to +20% (20.4 to 28.8 VAC).
3. Verify 16 VDC at terminals "16 VDC" and "COM".
    a. Tolerance is 15.0 to 17.0 VDC power supply to thermostat.
    b. If not correct, disconnect thermostat and recheck.
    c. If still incorrect, replace CSP controller.
4. Check "Requested Flow" DC voltage on terminal "2-10 IN" and "COM".
    a. Use Table 4 to correlate into cubic feet per minute (CFM).
    b. If reading is not what is desired, then adjust thermostat to give correct CFM.

NOTE: Never jumper terminal 16 VDC to "-" as this would cause a short, and possibly damage the power supply.

NOTE: When using the same transformer for more than one control, the phase and ground must be consistent with each device.

WATER VALVE INSTALLATION

WARNING: Disconnect power before wiring or electrical shock and personal injury could result.

Water valves are field supplied. Most control manufacturers offer three different hot water valve applications; on/off and floating point, and proportional control. The controls contractor should provide water valve specs used on controls supplied by others. To connect the field-supplied water valves to the controller, refer to the wiring labels for the control package.

APPENDIX A

TABLE 5.A: LMHS UNIT WEIGHTS

LMHS	UNIT WEIGHTS (lbs.)				HOT WATER COIL (DRY, lbs.)	
SIZE	BARE BOX	WITH PNEUMATIC	WITH DDC OR ANALOG	WITH ATTENUATOR	1 ROW	2 ROW
4,5,6	14	+4	+9	+10	+5	+6
7,8	16	+4	+9	+12	+5	+7
9,10	21	+4	+9	+16	+7	+9
12	26	+4	+9	+21	+9	+12
14	34	+4	+9	+24	+10	+15
16	38	+4	+9	+27	+12	+17
22	65	+4	+9	+30	+17	+25

TABLE 5.B: LMHS-LC UNIT WEIGHTS

LMHS	UNIT WEIGHTS (lbs.)				HOT WATER COIL (DRY, lbs.)		HOT WATER COIL (WITH WATER, lbs.)	
SIZE	BARE BOX	W/PNEUMATIC	W/ DDC OR ANALOG	W/ ATTENUATOR	1 ROW	2 ROW	1 ROW	2 ROW
4,5,6	16	+4	+9	+12	+5	+7	+5.8	+9.9
7,8	21	+4	+9	+16	+7	+9	+8.5	+12.6
9,10	26	+4	+9	+21	+9	+12	+11.0	+16.5
12	34	+4	+9	+24	+10	+15	+12.7	+21.8
14	38	+4	+9	+27	+12	+17	+15.1	+26.6

TABLE 6.A: LMHS BASIC PRESSURE AND AIRFLOW DATA												
INLET SIZE (AREA SQFT)	MAX AIRFLOW (CFM)	MIN AIRFLOW (CFM)		ELECTRIC HEAT* MAX Kw PER CFM @55F EAT		MIN INLET STATIC PRESSURE (UNIT & HEAT PRESSURE DROP)						
		COOLING ONLY OR WITH HOT WATER	ELECTRIC HEAT			VELOCITY PRESS	BASIC UNIT	BASIC WITH 1R - COIL	BASIC WITH 2R - COIL	BASIC WITH 3R - COIL	BASIC WITH 4R - COIL	BASIC WITH ELEC HEATER**
				CFM	Kw	Δ Vps	Δ Ps	Δ Ps	Δ Ps	Δ Ps	Δ Ps	Δ Ps
4 (0.09)	230	40	55	55	1	0.02	0.01	0.02	0.02	0.02	0.02	0.01
				110	2	0.1	0.05	0.06	0.07	0.08	0.09	0.05
				150	2.5	0.18	0.1	0.12	0.13	0.15	0.16	0.1
				230	3!	0.43	0.24	0.28	0.31	0.35	0.39	0.24
5 (0.14)	360	62	85	85	1.5	0.02	0.01	0.02	0.02	0.03	0.03	0.01
				140	2.5	0.06	0.03	0.05	0.06	0.07	0.09	0.03
				250	4.5	0.21	0.1	0.15	0.19	0.24	0.28	0.1
				360	5!	0.43	0.21	0.31	0.4	0.49	0.58	0.21
6 (0.20)	515	90	110	110	2	0.02	0.01	0.01	0.02	0.03	0.03	0.01
				250	4.5	0.1	0.04	0.09	0.13	0.17	0.22	0.04
				400	7.5!	0.25	0.1	0.22	0.34	0.45	0.56	0.1
				520	7.5!	0.42	0.17	0.38	0.57	0.75	0.94	0.17
7 (0.27)	700	121	140	140	2.5	0.02	0.01	0.01	0.02	0.03	0.04	0.01
				330	6	0.09	0.04	0.08	0.12	0.16	0.2	0.04
				550	9.5!	0.25	0.1	0.22	0.33	0.44	0.54	0.1
				700	9.5!	0.4	0.16	0.36	0.53	0.71	0.88	0.16
8 (0.35)	920	160	190	190	3.5	0.02	0.01	0.02	0.03	0.05	0.06	0.01
				440	8	0.09	0.04	0.12	0.19	0.25	0.32	0.04
				700	13!	0.23	0.1	0.29	0.47	0.64	0.82	0.1
				920	13!	0.39	0.17	0.51	0.81	1.11	1.42	0.17
9 (0.44)	1160	201	240	240	4.5	0.02	0.01	0.02	0.03	0.04	0.05	0.01
				550	10	0.08	0.04	0.09	0.14	0.19	0.24	0.04
				900	16!	0.23	0.1	0.25	0.38	0.52	0.66	0.1
				1160	16!	0.38	0.17	0.42	0.64	0.86	1.09	0.17
10 (0.55)	1430	248	300	300	5.5	0.01	0.01	0.02	0.03	0.04	0.05	0.01
				700	13	0.08	0.04	0.13	0.21	0.29	0.38	0.04
				1100	20.5	0.21	0.1	0.32	0.53	0.73	0.93	0.1
				1450	21!	0.36	0.17	0.56	0.91	1.26	1.62	0.17
12 (0.78)	2060	357	425	425	8	0.01	0.01	0.02	0.04	0.06	0.07	0.01
				1000	18.5	0.08	0.04	0.14	0.22	0.31	0.4	0.04
				1600	30!	0.2	0.1	0.35	0.57	0.8	1.02	0.1
				2060	30!	0.33	0.17	0.58	0.95	1.32	1.69	0.17
14 (1.07)	2800	486	580	580	11	0.01	0.01	0.02	0.04	0.05	0.06	0.01
				1375	26	0.07	0.04	0.13	0.21	0.28	0.36	0.04
				2100	36!	0.16	0.1	0.3	0.48	0.66	0.84	0.1
				2800	36!	0.29	0.18	0.53	0.85	1.17	1.49	0.18
16 (1.40)	3660	634	750	750	14	0.01	0.01	0.02	0.04	0.06	0.07	0.01
				1775	33.5	0.06	0.04	0.14	0.22	0.31	0.4	0.04
				2800	36!	0.14	0.1	0.34	0.56	0.77	0.99	0.1
				3660	36!	0.24	0.17	0.58	0.95	1.32	1.69	0.17
22 (2.63)	7000	1212	1800	1800	34	0.02	0.01	0.05	0.09	0.13	0.16	0.01
				3300	36!	0.07	0.04	0.18	0.3	0.42	0.55	0.04
				5300	36!	0.17	0.1	0.45	0.77	1.09	1.41	0.1
				7000	36!	0.3	0.17	0.79	1.35	1.91	2.46	0.17

NOTES:

1. Δ PS is the difference in Static Pressure across the assembly with the damper fully open.
2. To obtain Total Pressure, add the Velocity Pressure for a given CFM to the Static Pressure. Example: Pt for a Size 8 Basic Unit @925 CFM = 0.39 + 0.17 = 0.56
3. Max and Min Kw shown assumes 55°F entering air and is limited by unit's selected voltage, phase and max capacity. Minimum cfm for electric heat is based on UL/ETL listings. **NOTE:** Diffuser performance will likely be poor at this low flow rate.
4. Maximum discharge temperatures with Electric Heat are set at 120°F by the National Electric Code.

* The ASHRAE Handbook of Fundamentals does not recommend a discharge temperature exceeding 90°F.

** A minimum 0.10" discharge static pressure is required to ensure steady operation for the airflow switch in the electric heater.

*** Minimums for DDC by others are the responsibility of the controls' provider.

! Max Kw is limited by design.

TABLE 6.B: LMHS-LC BASIC PRESSURE AND AIRFLOW DATA								
INLET SIZE (AREA SQFT)	MAX AIRFLOW (CFM)	MIN AIRFLOW (CFM)	MIN INLET STATIC PRESSURE (UNIT & HEAT PRESSURE DROP)					
		COOLING ONLY OR WITH HOT WATER	CFM	BASIC UNIT	BASIC WITH 1R - COIL	BASIC WITH 2R - COIL	BASIC WITH 3R - COIL	BASIC WITH 4R - COIL
				Δ Ps	Δ Ps	Δ Ps	Δ Ps	Δ Ps
4 (0.09)	230	40	55 110 150 225	0.01 0.01 0.1 0.23	0.01 0.06 0.11 0.25	0.02 0.07 0.12 0.28	0.02 0.07 0.14 0.3	0.02 0.08 0.15 0.32
5 (0.14)	358	62	85 140 250 355	0.01 0.03 0.1 0.2	0.02 0.04 0.13 0.25	0.02 0.05 0.16 0.3	0.02 0.06 0.18 0.35	0.03 0.07 0.21 0.4
6 (0.20)	515	90	110 250 400 515	0.01 0.04 0.1 0.17	0.02 0.07 0.16 0.26	0.03 0.1 0.22 0..35	0.03 0.12 0.28 0.45	0.04 0.15 0.35 0.55
7 (0.27)	700	121	140 330 550 700	0.01 0.04 0.1 0.16	0.02 0.06 0.16 0.24	0.02 0.09 0.21 0.32	0.03 0.11 0.27 0.41	0.03 0.13 0.32 0.49
8 (0.35)	915	160	190 440 700 915	0.01 0.04 0.1 0.17	0.02 0.8 0.18 0.3	0.03 0.12 0.26 0.42	0.04 0.15 0.35 0.56	0.05 0.19 0.43 0.69
9 (0.44)	1160	201	240 550 900 1155	0.01 0.04 0.12 0.16	0.02 0.07 0.21 0.27	0.03 0.11 0.29 0.38	0.03 0.14 0.38 0.5	0.04 0.17 0.47 0.62
10 (0.55)	1430	248	300 700 1100 1430	0.01 0.04 0.1 0.17	0.02 0.09 0.2 0.32	0.03 0.14 0.3 0.48	0.05 0.19 0.41 0.66	0.06 0.24 0.52 0.82
12 (0.78)	2060	357	425 1000 1600 2060	0.01 0.04 0.1 0.17	0.02 0.09 0.2 0.32	0.03 0.13 0.3 0.47	0.04 0.18 0.41 0.65	0.05 0.23 0.52 0.8
14 (1.07)	2800	486	580 1375 2100 2800	0.01 0.04 0.1 0.18	0.03 0.1 0.22 0.36	0.04 0.16 0.33 0.55	0.05 0.22 0.46 0.77	0.07 0.28 0.58 0.96

NOTES:

1. Δ PS is the difference in static pressure across the assembly, with the damper fully open.

* The ASHRAE Handbook of Fundamentals does not recommend a discharge temperature exceeding 90°F.

** Minimums for DDC by others are the responsibility of the controls' provider.

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TABLE 6.C: RVE BASIC PRESSURE AND AIRFLOW DATA				
INLET SIZE (AREA SQFT)	MAX AIRFLOW (CFM)	MIN AIRFLOW (CFM)	FLOW RATE (CFM)	MIN ΔPs (IN WG)
4 (0.09)	230	40	40 103 167 230	0.007 0.048 0.126 0.239
5 (0.14)	360	62	62 161 261 360	0.008 0.052 0.137 0.261
6 (0.20)	515	90	90 233 377 520	0.007 0.05 0.131 0.249
7 (0.27)	700	121	120 330 525 700	0.007 0.056 0.142 0.252
8 (0.35)	920	160	160 440 675 920	0.008 0.059 0.138 0.256
9 (0.44)	1160	201	200 550 875 1160	0.008 0.058 0.146 0.257
10 (0.55)	1430	248	250 675 1075 1430	0.008 0.056 0.142 0.252
12 (0.78)	2060	357	360 1000 1550 2060	0.008 0.06 0.143 0.253
14 (1.07)	2800	486	480 1375 2125 2800	0.008 0.063 0.149 0.259
16 (1.40)	3660	634	630 1775 2725 3660	0.008 0.06 0.141 0.255

NOTES:

1. Δ Ps is the difference in static pressure across the assembly, with the damper fully open.
2. Minimum CFM value is based on a signal of 0.03 in w.g. differential pressure of the inlet.

TABLE 6.D: SVE BASIC PRESSURE AND AIRFLOW DATA

INLET SIZE	MAX AIRFLOW (CFM)	MIN AIRFLOW (CFM)	FLOW RATE (CFM)	MIN ΔPs (IN WG)
A	456	79	75 155 235 315	0.057 0.242 0.556 1
B	656	114	114 225 350 473	0.058 0.226 0.548 1
C	875	152	152 350 575 786	0.037 0.198 0.535 1
D	1458	253	253 475 675 902	0.079 0.278 0.561 1.001
E	2042	354	354 675 1000 1328	0.071 0.258 0.567 1
F	1969	351	341 650 950 1270	0.072 0.262 0.56 1.001
G	2188	379	379 725 1075 1435	0.07 0.255 0.561 1
H	3281	568	568 1175 1775 2414	0.055 0.237 0.541 1
J	3938	682	682 1475 2300 3121	0.048 0.223 0.543 1
K	5104	884	884 2225 3550 4923	0.032 0.204 0.52 1
L	6563	1137	1137 2925 4725 6563	0.013 0.085 0.222 0.429
M	6417	1111	1111 2850 4625 6417	0.017 0.11 0.29 0.559
N	7875	1364	1364 3525 5650 7875	0.013 0.086 0.221 0.43
P	10938	1894	1894 4875 7875 10938	0.013 0.086 0.223 0.43
R	14583	2526	2526 6500 10475 14583	0.013 0.085 0.221 0.429

NOTES:

1. Minimum CFM value is based on a signal of 0.03 in w.g. differential pressure of the inlet.

TABLE 7: LMHS ELECTRIC HEATER POWER WIRING													
HEATER SIZE (kW)	BTUH	120V HEATER		208V HEATER		240V HEATER		277V HEATER		208V 3Φ HEATER		480V 3Φ HEATER	
		FLA	AWG*	FLA	AWG*	FLA	AWG*	FLA	AWG*	FLA	AWG*	FLA	AWG*
0.5	1,701	4.2	14	2.4	14	2.1	14	1.8	14	1.4	14	0.6	14
1.0	3,413	8.3	14	4.8	14	4.2	14	3.6	14	2.8	14	1.2	14
2.0	6,826	16.7	10	9.6	14	8.3	14	7.2	14	5.6	14	2.4	14
3.0	10,239	25.0	8	14.4	12	12.5	12	10.8	14	8.3	14	3.6	14
4.0	13,652	33.3	8	19.2	10	16.7	10	14.4	12	11.1	14	4.8	14
5.0	17,065	41.7	5	24.0	10	20.8	10	18.1	10	13.9	12	6.0	14
6.0	20,478			28.8	8	25.0	8	21.7	10	16.7	10	7.2	14
7.0	23,891			33.7	8	29.2	8	25.3	8	19.4	10	8.4	14
8.0	27,304			38.5	6	33.3	8	28.9	8	22.2	10	9.6	14
9.0	30,717			43.3	6	37.5	6	32.5	8	25.0	8	10.8	12
10.0	34,130							36.1	6	27.8	8	12.0	12
11.0	37,543							39.7	6	30.5	8	13.2	12
12.0	40,956							43.3	6	33.3	8	14.4	12
14.0	47,782									38.9	6	16.8	10
16.0	54,608									44.4	6	19.2	10
18.0	61,434											21.7	10
20.0	68,260											24.1	10
22.0	75,086											26.5	8
24.0	81,912											28.9	8
26.0	88,738											31.	8
28.0	95,564											33.7	8
30.0	102,390											36.1	6
32.0	109,216											38.5	6
34.0	116,042											40.9	6
36.0	122,868											43.3	6

REPLACEMENT PARTS

PRIMARY DAMPER ASSEMBLY	PART NUMBER
4, 5, 6" Round (Includes Damper Blade And Shaft)	30182001
7" Round (Includes Damper Blade And Shaft)	30182002
8" Round (Includes Damper Blade And Shaft)	30182003
9" Round (Includes Damper Blade And Shaft)	30182004
10" Round (Includes Damper Blade And Shaft)	30182005
12" Round (Includes Damper Blade And Shaft)	30182006
14" Round (Includes Damper Blade And Shaft)	30182007
16" Round (Includes Damper Blade And Shaft)	30182008
Size 20 - 13 1/2" x 7 7/8" Rectangle (Includes Damper Blade And Shaft)	3512701200
Size 22 - 23 7/8" x 15 7/8" (Includes Opposed Blade Damper And Shaft)	10336604

PNEUMATIC TUBING, TEES AND CAPS	PART NUMBER
Tee, 1/4", Connects Pneumatic Tubing Each	42150011
Cap, 1/4", for Pneumatic Tubing Each	42160081
Tubing, 1/4", Red, for Pneumatic Controls (1 Foot Length)	61510035
Tubing, 1/4", Green, for Pneumatic Controls (1 Foot Length)	61510234
Tubing, 1/4", Yellow, for Pneumatic Controls (1 Foot Length)	61510260
Tubing, 1/4", Gray, for Pneumatic Controls (1 Foot Length)	10221501
Inline Filter for 1/4" Pneumatic Tubing	10154701

FOUR QUADRANT, K4 LINEACROSS INLET AIRFLOW SENSOR	PART NUMBER
4" Inlet	15010904
5" Inlet	15010904
6" Inlet	15010906
7" Inlet	15010907
8" Inlet	15010908
9" Inlet	15010909
10" Inlet	15010910
12" Inlet	15010912
14" Inlet	15010914
16" Inlet	15010916
22" Inlet (Requires [2] Sensors Per Unit)	15010914

TRANSFORMERS	PART NUMBER
120 volts to 24 volts, 50 VA	10029301
120 volts to 24 volts, 75 VA	10336801
277 volts to 24 volts, 50 VA	10006601
277 volts to 24 volts, 75 VA	10313401
208/240 volts to 24 volts, 50 VA	10057501
208/240 volts to 24 volts, 75 VA	10336901
480 volts to 24 volts, 50 VA	10100301
24 volts to 24 volts, 50 VA	10166601

ELECTRIC HEAT AND LINEAHEAT	PART NUMBER
Thermal Cutout, Automatic Reset (115-130° Limit)	10052101
Thermal Cutout, Manual Reset (160° Limit)	10118801
Disconnect Switch 30A Assembly (Does not include Snap-In Neutral Block)	31453101
Disconnect Switch 60A Assembly (Does not include Snap-In Neutral Block)	31453102
Disconnect Neutral Block - 30A (Snap-In)	10341201
Disconnect Neutral Block - 60A (Snap-In)	10341202
Magnetic Contactor, 30A, 24V Coil, 1 Pole (DIGITAL/ ANALOG)	10323601
Magnetic Contactor, 30A, 24V Coil, 2 Pole (DIGITAL/ ANALOG)	10054401
Magnetic Contactor, 60A, 24V Coil, 2 Pole (DIGITAL/ ANALOG)	10162501
Solid State Relay - 1 Pole, 50A (AC Volt)	15018001
EHM Board (including Mounting Bracket)	35134901
Solid State Relay - 1 Pole, 50A (DC Volt) [Crydom CWD 4850]	15012101
Heat Sink	15012001
Discharge Temperature Sensor	HH79NZ074

LMHS WATER COILS - 1 ROW	PART NUMBER
Unit Size 4-6	00-20018-02
Unit Size 7-8	00-20019-02
Unit Size 9-10	00-20022-02
Unit Size 12	00-20034-02
Unit Size 14	00-20038-02
Unit Size 16	00-20039-02
Unit Size 20	00-20360-02
Unit Size 22	00-20051-02

LMHS WATER COILS - 2 ROW	PART NUMBER
Unit Size 4-6	00-20020-02
Unit Size 7-8	00-20021-02
Unit Size 9-10	00-20023-02
Unit Size 12	00-20024-02
Unit Size 14	00-20025-02
Unit Size 16	00-20030-02
Unit Size 20	00-20359-02
Unit Size 22	00-20029-02

NOTE: 1 & 2 Row Coils can be used for both left and right-hand orientation.

LMHS WATER COILS - 3 ROW	PART NUMBER
Unit Size 4-6	00-20042-02 (RH) 00-20065-02 (LH)
Unit Size 7-8	00-20031-02 (RH) 00-20066-02 (LH)
Unit Size 9-10	00-20032-02 (RH) 00-20067-02 (LH)
Unit Size 12	00-20033-02 (RH) 00-20068-02 (LH)
Unit Size 14	00-20043-02 (RH) 00-20069-02 (LH)
Unit Size 16	00-20044-02 (RH) 00-20070-02 (LH)
Unit Size 22	00-20050-02 (RH) 00-20071-02 (LH)

LMHS WATER COILS - 4 ROW	PART NUMBER
Unit Size 4-6	00-20056-02 (RH) 00-20058-02 (LH)
Unit Size 7-8	00-20047-02 (RH) 00-20059-02 (LH)
Unit Size 9-10	00-20048-02 (RH) 00-20060-02 (LH)
Unit Size 12	00-20049-02 (RH) 00-20061-02 (LH)
Unit Size 14	00-20054-02 (RH) 00-20062-02 (LH)
Unit Size 16	00-20055-02 (RH) 00-20063-02 (LH)
Unit Size 22	00-20057-02 (RH) 00-20064-02 (LH)

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