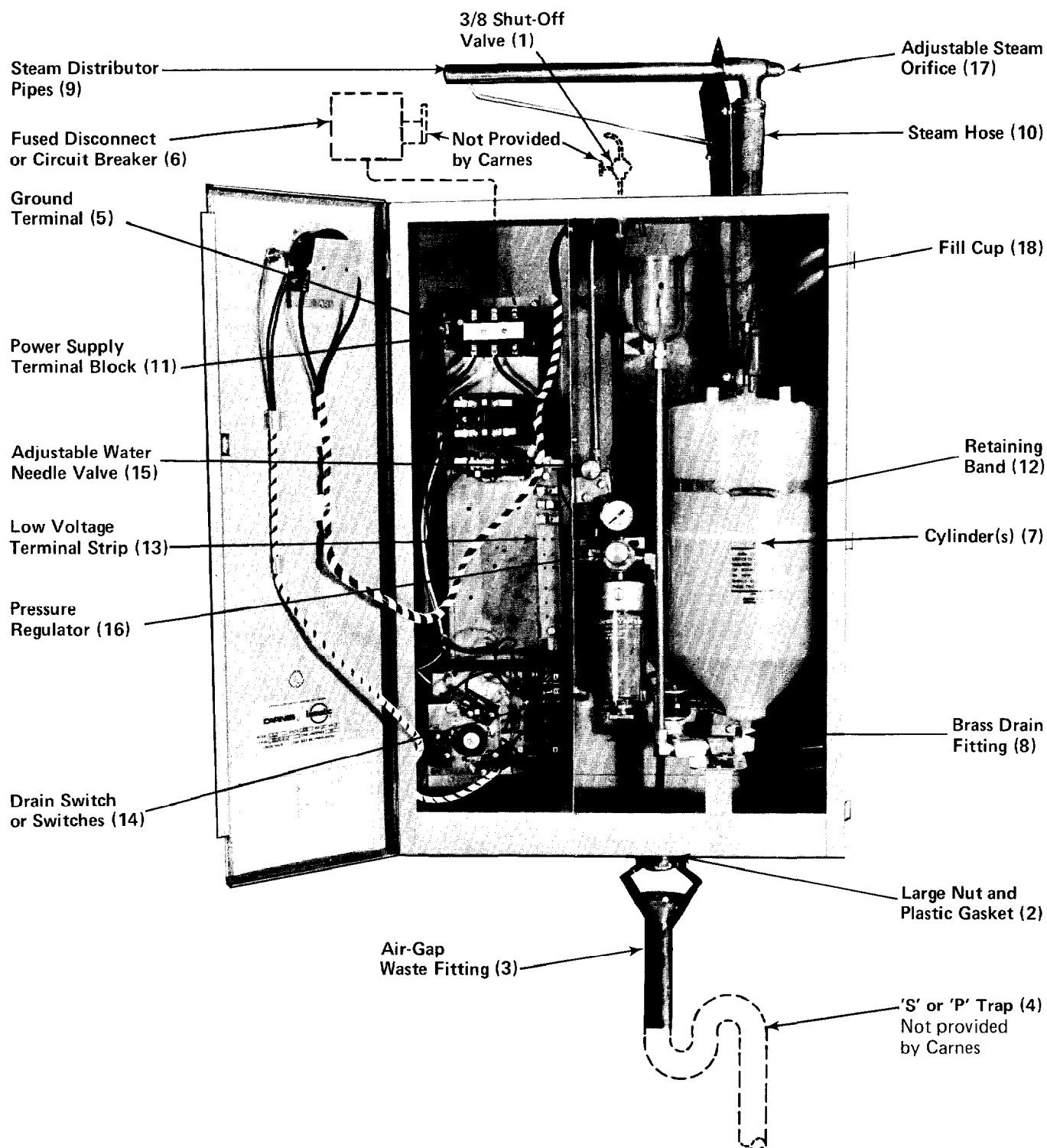


LUMATIC HUMIDIFIER

CARNES COMPANY, VERONA, WISCONSIN

TYPICAL LUMATIC HUMIDIFIER (Figure A)

INSTALLATION

UNPACKING AND INSPECTION

1. A manilla envelope attached to the outside of the Lumatic cabinet contains the following items:
 - A. Two cabinet keys
 - B. Wiring Diagram – Form 16602
 - C. Parts List – Form 16623
 - D. Installation instructions – Form 16603
 - E. Cable ties for hoses
2. Unlock the cabinet and check for concealed shipping damage. Report any damage immediately to the carrier who delivered the shipment.
3. The following components are packed in the shipping carton for connection when installing the Lumatic:
 - A. Distributor pipe(s).
 - B. Cylinder(s). The cylinders packed within the Lumatic cabinet are upside down to prevent shipping damage.
 - C. Air-gap waste fitting.
 - D. Steam hose (Total number of feet for all circuits).
 - E. Condensate return line (Total number of feet for all circuits).
4. **Table 1** indicates the number of components supplied with each Lumatic. Optional accessories (e.g., humidistats, standpipe, etc.) may be packed with the cabinet or in the same shipping carton. Large accessories may ship in separate cartons.

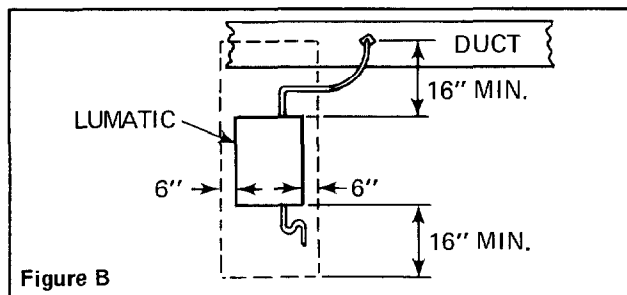
Table 1 – Lumatic Components

Model Number	Cylinders in Cabinet	Spare Cylinders	Distributor Pipes	Air-Gap Waste Fitting
L1 & L4	1	1	1	1
L2 & L5	2	2	2	1
L3 & L6	3	3	3	1

5. Inside the cabinet are the following items:
 - A. Pipe dope.
 - B. Steam hose clamps (two per circuit).
 - C. Condensate return line clamps (one per circuit).
 - D. One key for resetting drain cycle timer.
 - E. Distributor pipe mounting template (one for each distributor pipe).

MOUNTING THE LUMATIC

Mount the Lumatic cabinet level and plumb on a surface near the ductwork, and 16" or more below the point at which the distributor pipe(s) will be installed. An accessory mounting frame may be used if surface is not plumb or studding is uneven. Allow 6" or more on each side for proper ventilation and a minimum of 16" from bottom to the floor to allow for drain connection. (See **Figure B** below)



WATER SUPPLY CONNECTION

Use only ordinary tap water – **DO NOT use hot or de-ionized water.** A 3/8" female FPT fitting is provided at the top of the Lumatic to connect to the tap water supply. A shut-off valve, not provided by Carnes, should be provided just ahead of this fitting.

DRAIN LINE CONNECTION

Refer to **Figure A**

1. Remove the large nut and plastic gasket located on the fitting on the bottom of the cabinet (2). The nut and gasket may be used with standard type waste fitting if an air-gap waste fitting is not required by local codes.
2. If required, connect the air-gap waste fitting (3) to the cabinet drain connection. Drop plastic insert into the top of the air-gap waste fitting before connecting. It may be necessary to cut off some of the air-gap fitting depending on the available space.
3. Connect the drain or air gap fitting to an S or P trap (4). **Note:** If the condensate pump accessory package is used, follow instructions included with the condensate pump package.

INSTALLATIONS OF CYLINDER(S)

Refer to **Figure A**

POWER MUST BE OFF BEFORE MAKING ANY ELECTRICAL CONNECTIONS.

1. Lumatic cylinder(s), (7) contained in the cabinet are shipped upside down to prevent shipping damage. Remove cylinder(s) and remove plastic protective caps on both ends of the cylinder.
2. Remove plastic plug from the brass drain fitting (8) located on the bottom of the Lumatic cabinet.
3. Apply pipe dope to threads on neck at the bottom of the cylinder.
4. Screw cylinder into fitting (8) – hand tighten only.
5. Connect retaining band (12) to secure cylinder in place.
6. Connect electrical quick connect terminals to cylinder terminals. Push them on securely (they are not threaded).

INSTALL STEAM DISTRIBUTOR PIPE(S)

Refer to **Figure A**

1. Steam distributor plate must be mounted on a plumb surface. When mounted on a plumb surface, the standard distributor pipe pitches downward. This is required so the condensate which forms in the distributor pipe will drain to the return line and back to the unit.
2. Steam distributor pipe(s), (9) should be mounted in the duct so that there will be even distribution of steam across the center portion of the duct (See **Figure C**). The condensate return line must always be kept on the bottom. A minimum clearance of 4" must be maintained between the duct and distributor pipe. The steam distributor pipes are designed with a hole pattern which gives even distribution yet keeps steam away from the sides of the duct. If a Lumatic with multiple steam generator circuits is used, it may be possible to use the steam distributor pipes as shown (See **Figure D**).

The standard Lumatic steam distributor pipe must never be installed vertically. If air flows are vertical, the

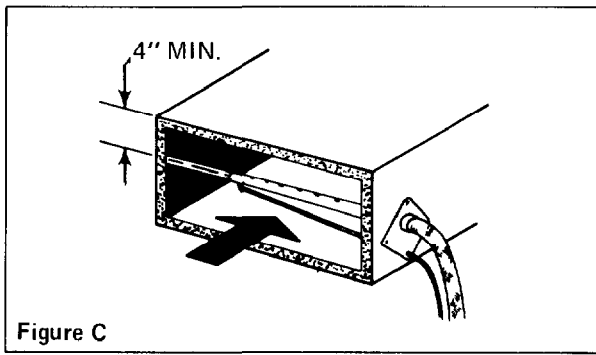


Figure C

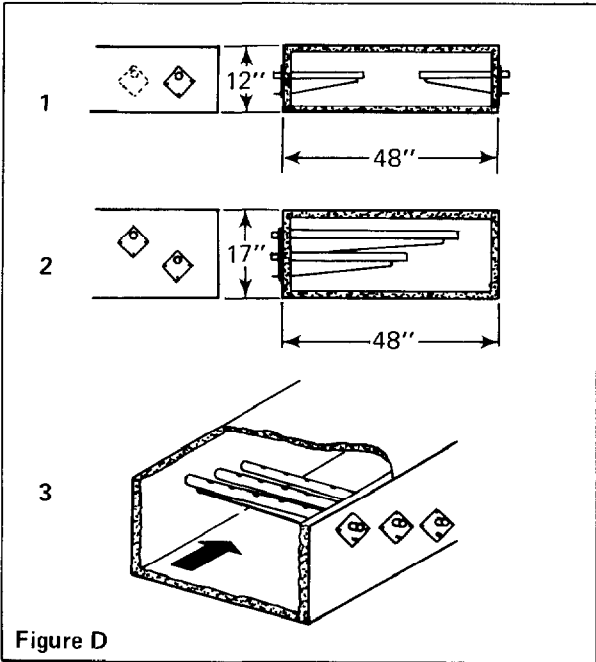


Figure D

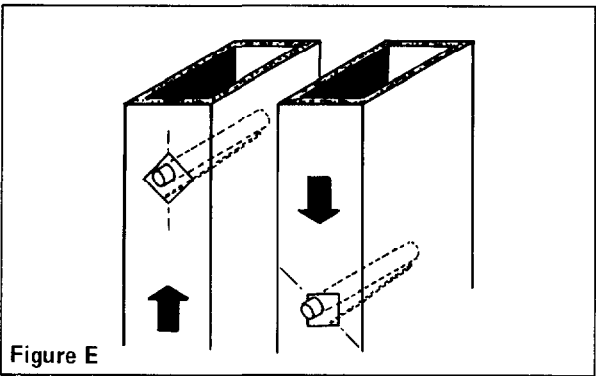


Figure E

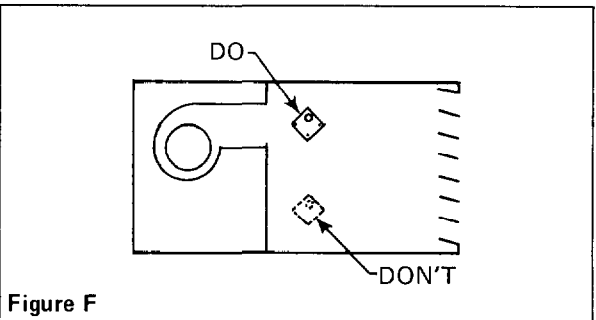


Figure F

Lumatic steam distributor pipe should be installed horizontally as shown (See Figure E).

The steam distributor pipes should be installed in the supply air stream, downstream of the fan (See Figure F). When installed in packaged units (central station air handlers, multizone units, make-up air units, etc.) the distributor pipe should be mounted just downstream of the fan discharge in the primary air stream.

In multizone applications it is preferable to have a Lumatic steam generator circuit serving each zone. However, steam can be introduced into the hot deck upstream of the zone dampers. In this case, good distribution of steam across the entire hot deck is very important.

Generally, it is preferable to mount the steam distributor pipes downstream from any obstructions in the ductwork coils, filters, zone dampers, elbows etc. If the steam distributor pipe is installed upstream of the obstructions, there should be a minimum of three feet between the steam distributor pipe and the obstruction. This same rule applies to outlets. In all cases, always install the steam distributor pipe as far upstream of the obstruction as possible.

The reason it is advised that the steam distributor pipes be mounted downstream from any obstructions is so that the air has a chance to absorb condensed moisture before it impinges on a surface and accumulates. If it is absolutely necessary to install a steam distributor pipe upstream of the fan (on the suction side) it is recommended that the pipe be installed as far upstream of the inlet as possible. A minimum of three feet from the inlet is mandatory.

3. An adhesive backed template is provided for each distributor pipe. This provides the hole pattern for mounting of each steam distributor pipe. Using the template(s), cut necessary holes in ductwork at desired location of distributor pipe.
4. Insert distributor pipe into duct and secure tightly with four sheet metal screws, not provided by Carnes.
5. Special distributor pipes are shipped with specific instructions on how to mount them.
6. If the accessory blower package is to be used, follow the instructions included with the blower package.

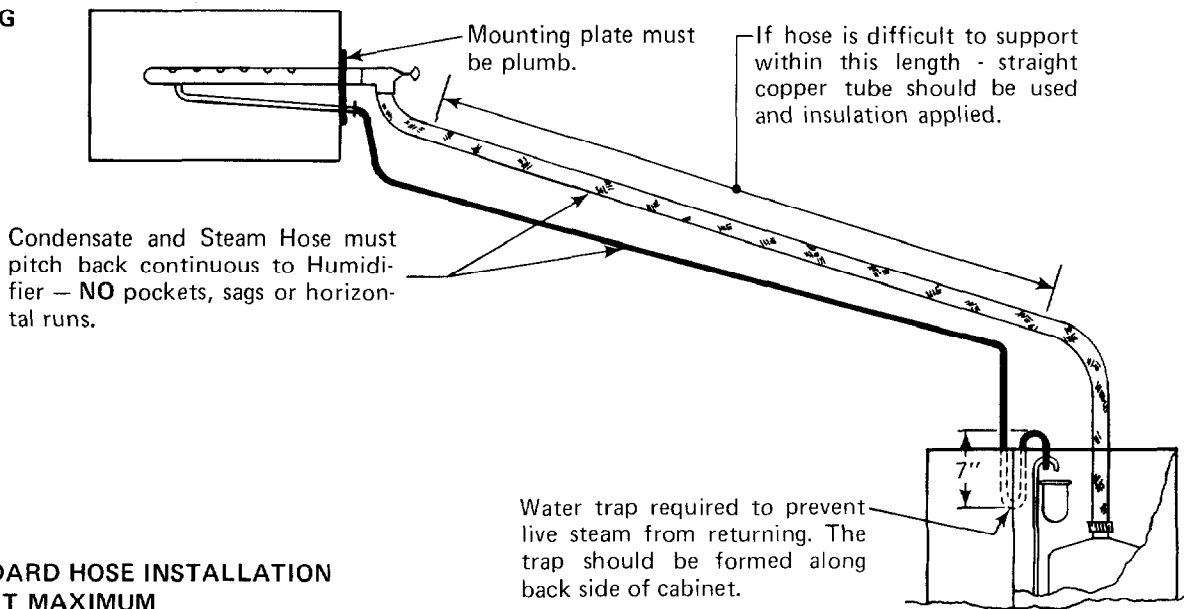
CONNECTING THE STEAM HOSE

Refer to Figure A, G, H and J

COPPER OR BRASS TUBE IS THE ONLY ACCEPTABLE SUBSTITUTE FOR CARNES STEAM HOSE OR CONDENSATE HOSE

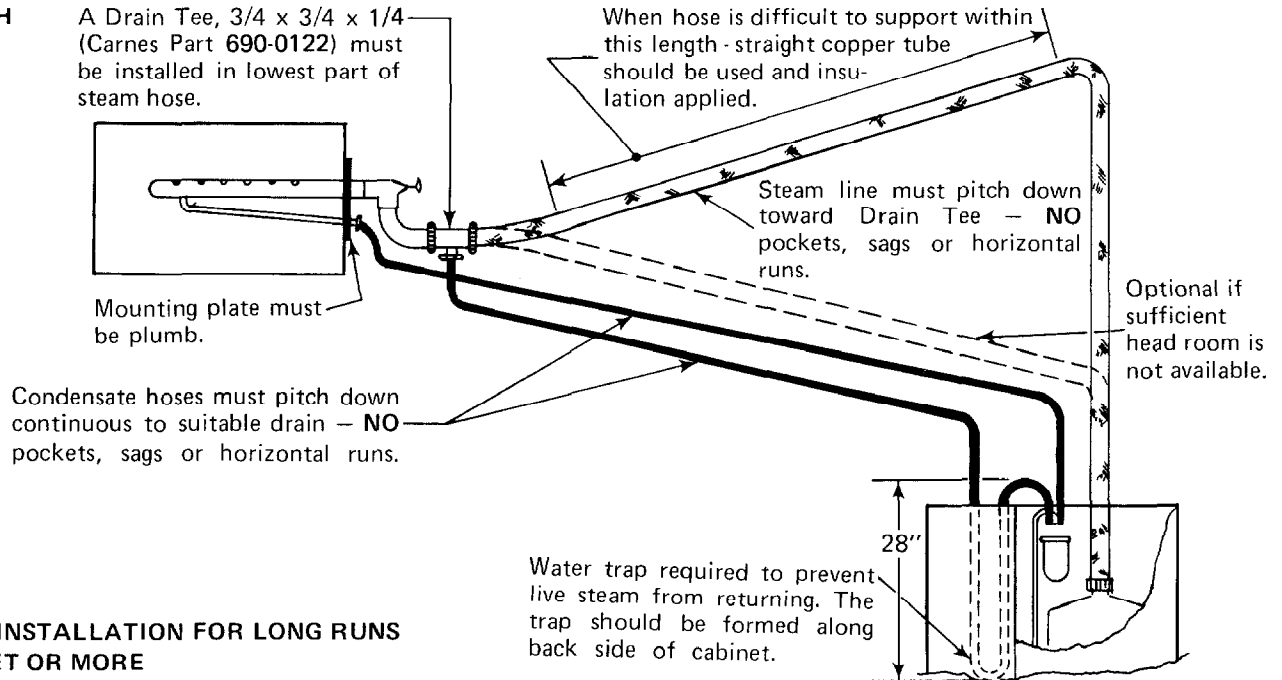
1. The steam hose (10) should be installed so there is a continuous rise from the Lumatic to the distributor pipe. Support the steam hose at intermediate points to prevent dips or pockets. If it is necessary to mount the distributor pipe below the top of the Lumatic, a "T" fitting must be installed at the lowest point in the steam hose to drain any condensate from the steam hose. Carnes part number 690-0121 is available for this application.
2. Any turns should have a minimum radius of 6" to prevent the hose from kinking.
3. Fasten the steam hose to the distributor pipe with one of the hose clamps provided.
4. Push the steam hose through the opening on the top of the Lumatic cabinet and slip over the outlet stub on the top of the cylinder. Fasten with the other hose clamp provided.

Figure G



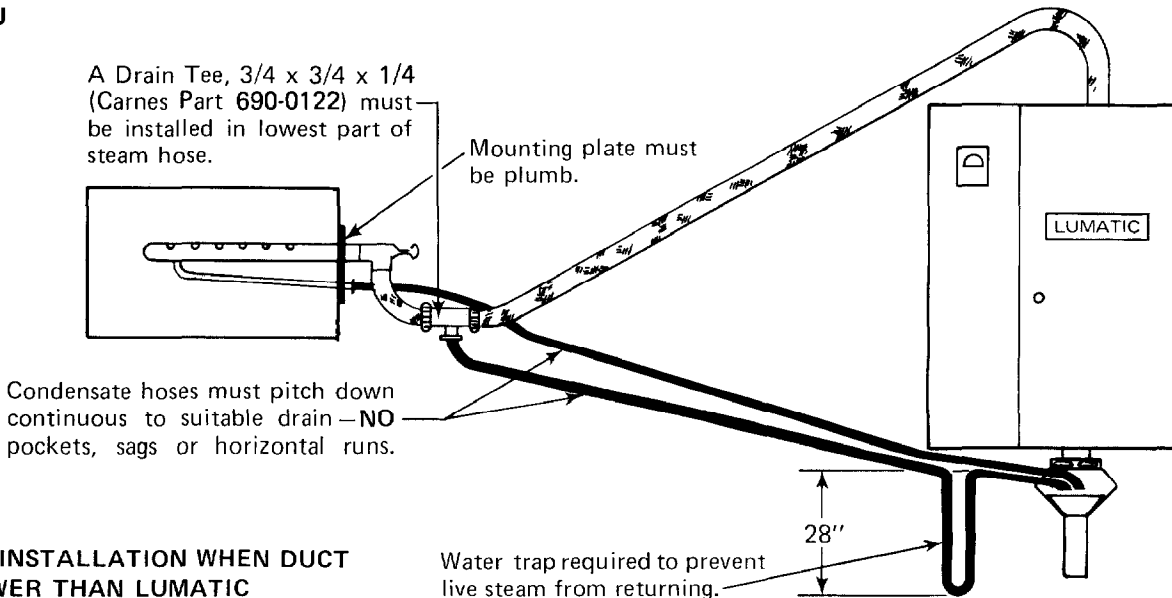
**STANDARD HOSE INSTALLATION
12 FEET MAXIMUM**

Figure H



**HOSE INSTALLATION FOR LONG RUNS
12 FEET OR MORE**

Figure J



**HOSE INSTALLATION WHEN DUCT
IS LOWER THAN LUMATIC**

CONDENSATE RETURN LINE

Refer to Figures G, H and J

1. Fasten the condensate return line to the distributor pipe with the hose clamp provided.
2. Follow the steam hose back to the Lumatic cabinet and secure the return line to the steam hose with the cable ties provided.
3. If it is impossible to maintain a drop to the top of the Lumatic cabinet, it is permissible to run the condensate return line directly to the Lumatic air-gap waste fitting or some other drain.
4. If negative duct pressures are encountered a 7" water trap must be formed in lowest end of tube from distributor pipe.

ELECTRICAL CONNECTIONS – MAIN POWER

Refer to Figure A

POWER MUST BE OFF BEFORE MAKING ANY ELECTRICAL CONNECTIONS.

Refer to wiring diagram, Form 16602, for detailed wiring diagrams. Check unit electrical characteristics on plate inside electrical section. It must agree with the power provided to the unit. If it does not, contact your Carnes Representative.

1. Connect cabinet ground terminal (5) to an independent ground. **DO NOT use the neutral of a four-wire power supply.**
2. A fused disconnect or circuit breaker, not provided by Carnes, (6), must be installed near the Lumatic cabinet per local and national electric codes. See **Table 2** for circuit breaker recommendations.
3. An electrical knock-out is provided on the top of the electrical section of each Lumatic. Bring power supply wires thru this knock-out connection and connect to the high voltage terminal block (11) at the top of the unit's electrical section.

CONTROL CONNECTIONS

1. Two half-inch conduit knock-outs are provided in the top of the cabinet. The control wiring should pass through the knock-outs to the terminal strip (13).

NOTE: A built-in transformer provides 24-volt power for the control circuit. No outside power supply is required for the control circuit.

2. The maximum total length of control wiring for a given wire gauge are shown in **Table 3**.

If these lengths are exceeded, excessive voltage drop may cause the contactors to "chatter" because of low voltage to the holding coils.

3. Form 16602, Lumatic Wiring Diagram, shows the complete electrical wiring of all Lumatic models, including the connection of controls. Typically, the Lumatic is controlled by: a) humidistat, b) fan interlock,

and/or c) air-flow switch. Often the humidistat and air-flow switches are combined into a single switch.

Shown below are **Figures K, L, M and N** representative control circuits commonly used with the Lumatic. Only field-wired connections are shown.

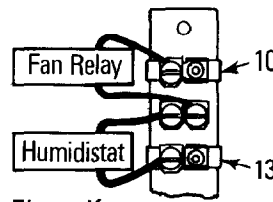


Figure K

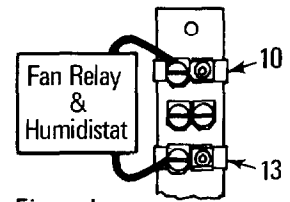


Figure L

Multi-cylinder units are delivered with jumper wires connecting all cylinders for operation from a single set of outside controls. Jumper wires must be removed if each cylinder is controlled separately.

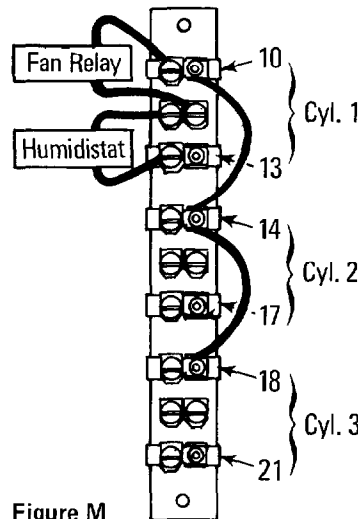


Figure M

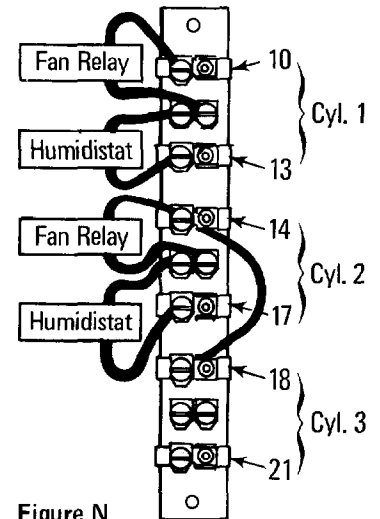


Figure N

All three cylinders operate from one set of controls.

First cylinder operated independently. Second and third cylinders operated together.

Table 3 – Maximum Control Wiring Length

Number of Cylinders on Control Circuit	Total Length – Out & Back Control Wiring Ft.			
	18 Gauge	16 Gauge	14 Gauge	12 Gauge
1 Cylinder	50'	75'	125'	200'
2 Cylinders	35'	55'	90'	135'
3 Cylinders	20'	30'	50'	75'

Table 2 – Recommended Circuit Breaker Rating in Amperes.

MODEL	120 Volts		208 Volts		220 Volts		230 Volts		240 Volts		277 Volts		440 Volts		460 Volts		480 Volts		550 Volts		575 Volts		600 Volts	
	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30	10	30
L-1	35	—	20	—	20	—	20	—	20	—	15	—	10	—	10	—	10	—	10	—	10	—	10	—
L-2	70	—	40	25	40	25	40	25	35	20	30	—	20	15	20	15	20	15	15	10	15	10	15	10
L-3	100	—	60	35	60	35	60	35	60	30	45	—	30	20	30	20	30	20	30	20	30	20	30	20
L-4	—	—	—	35	—	35	—	35	—	30	—	—	—	20	—	20	—	20	—	15	—	15	—	15
L-5	—	—	—	70	—	70	—	70	—	60	—	—	—	35	—	35	—	30	—	30	—	25	—	25
L-6	—	—	—	100	—	100	—	100	—	90	—	—	—	50	—	50	—	45	—	40	—	40	—	40

OPERATION

START-UP OF THE LUMATIC

Refer to Figure A

1. While the main disconnect switch is still **OFF**, be sure the power supply leads are secured firmly to the terminals on the top of each cylinder.
2. Turn on water supply at the shut-off-valve (1) in the water line to Lumatic cabinet.
3. Throw main disconnect to **ON**, Power is now supplied to the unit.
4. Switch On-Drain switches (14) to the ON position.
5. Turn the unit on by:
 - a. Turning humidistat up until there is a call for humidity, or
 - b. Installing a temporary jumper between humidistat terminals 10 and 13 on the low voltage terminal strip.
6. You will hear the power contactors close and the pilot light next to the ammeter on the front of the electrical section should come on. If it does not, check for defective bulb.
7. Open the adjustable water needle valve (15) approximately 1/2 turn so that the water starts to flow into the fill cup. (You will have to adjust the flow later.)
8. Adjust the pressure regulator (16) so that it is reading approximately 5 psi when water is flowing to all cylinders.
9. As water rises and makes contact with the electrodes in the cylinder, the ammeter will indicate that contact has been made. The amperage will begin to rise as the water level rises.

NOTE: The timer located at the bottom of the electrical section periodically drains some of the water and mineral deposits from the cylinder(s). This will increase the start-up time somewhat, therefore, you may want to disconnect one of the leads on the drain solenoid valve until the unit is adjusted properly.
10. The steam distributor pipe has a screwdriver adjustment (17) on the adjustable steam orifice. Adjust it to the fully closed (screwed in) position for the initial start-up. (At this position the orifice will still be partially open).
11. From Table 4 or Table 5, determine the amp draw required for this Lumatic.
12. Watch the ammeter as the water level rises in the cylinder. Since this incoming water is cold, the level may go too high before it actually begins to boil. If this occurs, the ammeter will indicate excessive amperage. Therefore, switch the manual On-Drain switch to Drain and allow the water level to drop approximately 3/4" then switch back to ON position. This may be required a couple of times before the water begins to boil.

Table 4 — AMP Draw as a function of Power Supply Voltage and desired Steam Output Rate (pounds per hour) - Per Circuit Models L-1, L-2 and L-3.

Kilowatt Hours	Steam Output Rate (Lbs./Hr.)	MODELS L1, L2 and L3											
		Voltage											
		120	208	220	230	240	277	440	460	480	550	575	600
3.3	9.6	28.2	15.9	15.1	14.4	13.8	12.0	7.5	7.2	6.9	6.0	5.7	5.5
3.1	9	26.4	14.9	14.1	13.5	12.9	11.2	7.1	6.8	6.5	5.6	5.4	5.2
2.8	8	23.5	13.3	12.5	12.0	11.5	10.0	6.3	6.0	5.8	5.0	4.8	4.6
2.4	7	20.6	11.6	11.0	10.5	10.1	8.7	5.5	5.3	5.0	4.4	4.2	4.0
2.1	6	17.6	10.0	9.4	9.0	8.6	7.5	4.7	4.5	4.3	3.8	3.7	3.5
1.7	5	14.7	8.3	7.8	7.5	7.2	6.2	3.9	3.8	3.6	3.1	3.0	2.9
1.4	4	11.7	6.6	6.3	6.0	5.8	5.0	3.1	3.0	2.9	2.5	2.4	2.3
1.0	3	8.8	5.0	4.7	4.5	4.3	3.7	2.4	2.3	2.2	1.9	1.8	1.7

Table 5 — AMP Draw as a function of Power Supply Voltage and desired Steam Output Rate (pounds per hour) Per Circuit, Models L-4, L-5 and L-6.

Kilowatt Hours	Steam Output Rate (Lbs./Hr.)	MODELS L4, L5 and L6									
		Voltage									
		208	220	230	240	440	460	480	550	575	600
9.9	28.7	27.5	26.0	24.9	23.8	13.0	12.4	11.9	10.4	9.9	9.5
9.7	28	26.8	25.4	24.2	23.2	12.7	12.1	11.6	10.1	9.7	9.3
9.0	26	24.9	23.5	22.5	21.6	11.8	11.3	10.8	9.4	9.0	8.6
8.3	24	23.0	21.7	20.8	19.9	10.9	10.4	10.0	8.7	8.3	8.0
7.6	22	21.1	19.9	19.1	18.3	10.0	9.5	9.1	8.0	7.6	7.3
6.9	20	19.2	18.1	17.3	16.6	9.1	8.7	8.3	7.2	6.9	6.6
6.2	18	17.2	16.3	15.6	14.9	8.1	7.8	7.5	6.5	6.2	6.0
5.5	16	15.3	14.5	13.9	13.3	7.2	6.9	6.6	5.8	5.5	5.3
4.8	14	13.4	12.7	12.1	11.6	6.3	6.1	5.8	5.1	4.8	4.6
4.1	12	11.5	10.9	10.4	10.0	5.4	5.2	5.0	4.3	4.2	4.0
3.5	10	9.6	9.1	8.7	8.3	4.5	4.3	4.1	3.6	3.5	3.3

BALANCING LUMATIC OPERATION

1. As soon as the water in the cylinder is boiling, the steam pressure will stabilize the water level in the cylinder. The amperage shown on the ammeter will probably be less than was selected in **Table 4 or 5** and the water level will probably be below the 5-line on the cylinder.
2. To increase the amperage and the water level in the cylinder, open the screwdriver adjustment two turns on the adjustable steam orifice. After each change of the adjustable steam orifice setting allow approximately three minutes to allow the water level and amperage to stabilize again.

NOTE: The adjustment screw on the steam orifice is in its maximum open position when it has been opened 1/2", opening the adjustment beyond this point will have minimum effect.

3. Continue making this type of adjustment until the desired amperage is achieved. When the desired amperage is achieved the water level may be between the 5 and 10-lines marked on the cylinder.
4. If the desired amperage cannot be achieved or if the water level is not between the 5 and 10-lines on the cylinder, refer to **Table 6**.

The Lumatic will operate satisfactorily with the water level as low as line-2, as long as the water level does not drop off the electrodes during the drain cycle.

5. Once correct amp draw is reached, reconnect lead to the drain solenoid valve.
6. Adjust water flow to compensate for the draining interval (make sure the water is flowing in at a fast enough rate so the correct amp draw is reached before the next drain takes place). The water level should be near the bottom of the fill cup (18). It is not unusual for fluctuations in water level to cause small amounts to pass through the overflow drain occasionally.
7. Remove jumper wires from terminals 10 and 13 if they were used to simulate call for humidity.
8. Lock adjustable steam valve on distributor pipe in place by tightening lock nut against valve body.

Table 6 – Corrective Measures using New Steam Cylinders

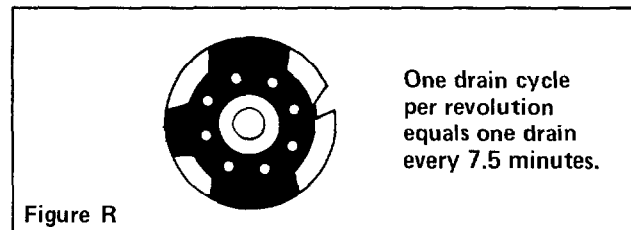
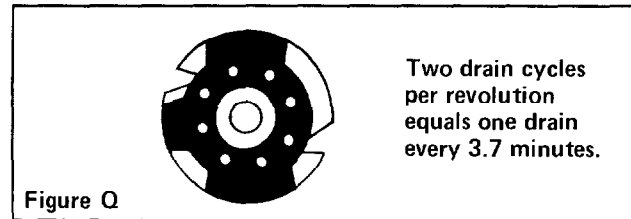
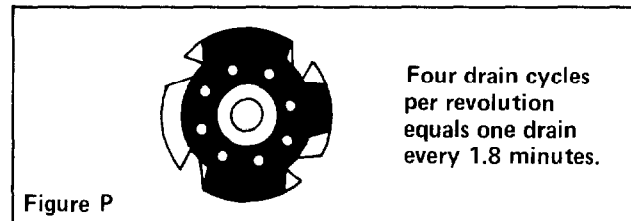
Amperage Reading	Water Level	To Improve Performance	When Ordering Replacement Cylinders
OK	Above 10-line	Use next lower number cylinder	Order next lower number cylinder
OK	Below 5-line	Use next higher number cylinder	Order next higher number cylinder
Above desired reading	OK	Decrease steam orifice opening, and/or decrease make-up water flow	Order next higher number cylinder
Above desired reading	Above 10-line	Decrease steam orifice opening, and/or decrease make-up water flow	Order same number cylinder
Above desired reading	Below 5-line	Decrease steam orifice opening, and/or decrease make-up water flow, and/or increase frequency of drain cycle	Order next higher number cylinder
Below desired reading	OK	Increase steam orifice opening, and/or increase make-up water flow	Order next lower number cylinder
Below desired reading	Above 10-line	Increase steam orifice opening, and/or increase make-up water flow	Order next lower number cylinder
Below desired reading	Below 5-line	Increase steam orifice opening, and/or increase make-up water flow	Order same number cylinder

DRAIN CYCLE TIMER

The timer has been factory set for the water conditions in your area. It can be easily reset if necessary.

1. The timer periodically drains a portion of the water from the cylinder to remove sludge and mineral enriched water. By rotating the top cam counter-clockwise, with the timer key, the timer can be set to drain every 1.8 minutes (**Figure P**), 3.7 minutes (**Figure Q**) or 7.5 minutes (**Figure R**).
2. Set timer to 7.5 minute cycle for low mineral content water.

The 3.7 minute or 1.8 minute cycle is recommended for mineral rich water. High organic content water or water that increases rapidly in conductivity when boiled may require the 1.8 minute cycle.



MAINTENANCE

It is advisable to inspect the Lumatic Humidifier visually at regular intervals. A weekly inspection is suggested.

REPLACEMENT OF CYLINDER

A cylinder needs replacing when the indicator light is on, the amperage is zero and the water level is near the top of the cylinder. Refer to **Installation of Cylinder(s)** on page 2 of this manual for replacement procedure.

After replacing Lumatic cylinder, order a replacement set immediately. This would insure having a spare set on hand when the next change is required. The original shipment contains one spare set of cylinders. It is also advisable to have a spare water filter on hand.

REPLACEMENT OF WATER FILTER

Occasionally it will be necessary to readjust the pressure regulator to maintain 5 psi.

Depending on the turbidity of the water, the filter cartridge will eventually be filled with mineral and organic particles. When this occurs, it will not be possible to maintain 5 psi with the pressure regulator wide open and the water flow rate will be insufficient to feed the cylinder. The cartridge must then be replaced or cleaned. Refer **Figure S**.

1. Turn off water supply **Figure A valve (1)**.
2. Remove knurled nut (A), cup (C) and hex nut (D). Complete cartridge assembly can now be slipped off center tie rod.
3. When reassembling be sure the shouldered type end washer (E) is in the upper position as shown in **Figure S**.

From time to time the drain solenoid valve and drain lines may need cleaning. By putting the manual "ON-DRAIN" switch for each in the "DRAIN" position, it can be determined when cleaning is necessary. Observation at the air-gap waste will immediately show if the drain lines and drain solenoid are sufficiently clear.

If humidification is not going to be required for a long period of time (e.g., during summer cooling cycle in a comfort application) it is recommended that each steam generator cylinder be drained down completely using the "ON-DRAIN" manual switch before switching off the power to the Lumatic and closing the water supply valve.

