COMPUTER ROOM HUMIDIFICATION

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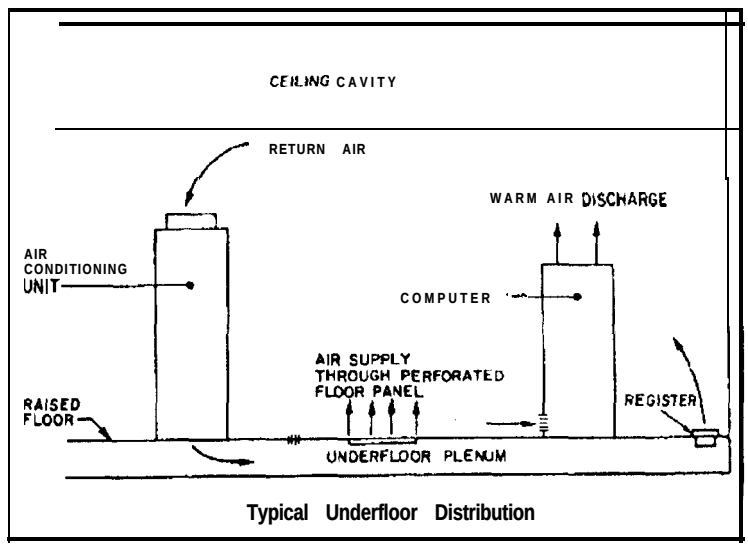
In this report, we will discuss how to humidity computer rooms. We will cover the reasons why humidification is necessary, what problems must be addressed, how to size the humidifier and how best to introduce humidity to the room.

THE NEED FOR HUMIDIFICATION

Computer Rooms, also known as Data Processing System areas, need humidification. The major reason is static electricity. Static charges can accumulate and discharge at low relative humidities. This can damage electronic components and data storage.

Controlled humidity can increase personnel comfort and reduce problems with paper/ card feeding. Paper does not bend or tear as easily at higher humidities.



Typical Underfloor Distribution

COOLING IS REQUIRED

Main frame computer systems require cooling year-round since they generate so much heat. To provide this cooling on a year round basis efficiently, a dedicated cooling system is required. Air conditioners have been developed to stand in the computer room and provide this needed year round cooling. Typically they are self contained with compressors or pumps, cooling coils and control systems, all mounted in an upright cabinet.

Typical computer room air conditioner units incorporate integral humidifiers. The air conditioner's primary function is to cool the air which has been heated by the computers with humidification asasecondary subsystem. The cool, humidified, conditioned air isthen delivered to the computer room.

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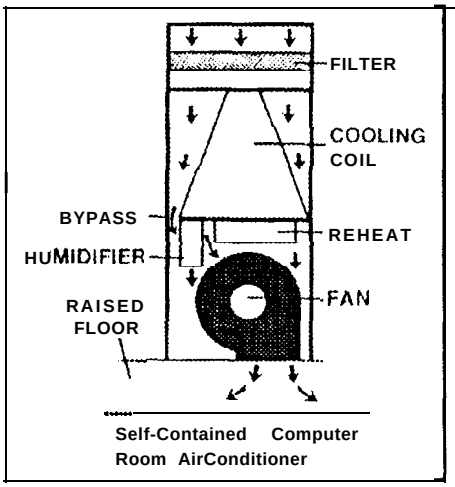
The typical air conditioner layout looks like this:



Self-Contained Computer Room AirConditioner

THE PROBLEMS

A survey by Armstrong Representatives in 1985 showed that over 50% of the humidifiers in computer room air conditioners were shut off. The major reasons are:

1. Cold air leavina the air conditioner can support very little moisture. As can be seen from the air conditioner layout, the humidity is mixing with the chilled air from the cooling coils. If this mixed air temperature is below 55° F. (and it usually is), problems are sure to follow. ASHRAE recommends these conditions in the computer room:

TYPICAL COMPUTER ROOM DESIGN CONDITIONS [a]	
Temperature set point and offset	72 ± 2°F (22 ± 1°C)
Relative humidity set point and offset	50 ± 5%
Filtration quality (ASHRAE Std. 52-76 dust spot efficiency test)	45%, minimum 20%

a These conditions are typical and fall within the conditions recommended by most computer equipment manufacturers.

If 72°F. and 50% RH are desired, then at 55°F. leaving temperature, the relative humidity will exceed 90%, this is very difficult to control ,especially with no high limit humidistat. In addition, under the air conditioner, any cold spots in the distribution system can condense water, setting off moisture alarms. The solution is to shut off the humidifier!

2. Reliability. If the humidifier does not receive regular maintenance, or poor water quality exists, or expensive parts are required on a regular basis, (sometimes all three!), it will be shut off simply because it is a nuisance.

3. Low-limit alarms. Many air conditioners will set an alarm off when the room humidity drops too far (to say, 45% RH). Because of the cold air problem (see

previous) it is likely that the humidity will drop regularly, setting off the alarm regularly. Since most alarms can be overridden, (and this one is) the humidifier can be ignored and eventually shut off (see previous).

HUMIDITY - Plus another problem

In order to size a humidifier for a computer facility, three things need to be determined:

1. Cooling tonnage - from air conditioner ratings
2. Room temperature - what is thermostat setting
3. Desired relative humidity

DESIRED RELATIVE HUMIDITY. ASHRAE recommends a relative humidity setting of 50% RH ± 5%. However, as discussed, the cooled air conditions are not conducive to maintaining 50% RH. The cooling coil is actually dehumidifying-which uses energy twice. Once for the humidifier to put moisture in, twice when the cooling coil dehumidifies it out. In addition, the control circuits are fighting each other, with the resultant loss of accuracy. Therefore, a humiditv setting of 45% RH will result in less eneray consumption. and probably better control, and still meet the ASHRAE recommendation.

LOAD CALCULATION

To determine the cooling induced humidification load, simply multiply the figure in the table by the number of tons of cooling:

A. **Humidification requirement in #/hr/ton at conditions shown (Leaving air temptera-ture of cooling system = 50°F., 80% RH).***

Room Humidity % RH	Room Temp °F.			
	68°F	70°F	72°F	75°F
40%	0	0	0.7	1.9
45%	0.5	1.3	2.2	3.5
50%	1.8	2.7	3.7	5.2
55%	3.1	4.1	5.1	6.8

B. **Humidificatii requirement in #/hr/ton at conditions shown (Leaving air tempterature of cooling system = 52°F, 80% RH).***

Room Humidity % RH	Room Temp °F			
	68° F	70°F	72°F	75°F
40%	0	0	0	1.1
45%	0	0.5	1.3	2.7
50%	**1.0**	1.9	2.8	4.3
55%	2.3	3.3	4.3	6.0

* Notes: - 0 air changes to outside air (assumed no leakage)
- 0 CFM exhaust or makeup air (100% recirculated)
-Air conditioner cooling coil leaving conditions assumed to be 50°F and 80% RH (50 DE, 47 WB).
- Based on 400 cfm/ton for 500 cfm/ton, multiply by 1.25 to find new load
- 1 ton = 12,000 BTU/hr (Btuh)
- A nominal 5#/hr should always be provided

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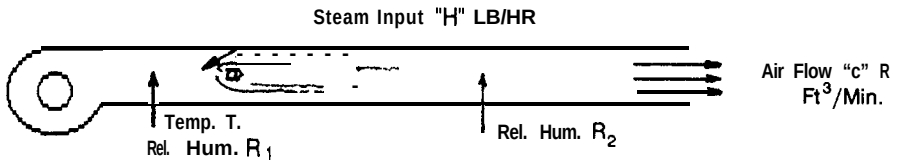
HOW TO SOLVE THE PROBLEMS

Since it is difficult, if not impossible, to humidify the air in the air conditioner, a warmer air source must be used. The computer room air, being at 72°F. is an ideal source. A recirculation system can be installed to draw computer room air out, humidify it, and distribute it back into the room. To determine the air flow required to support the humidification load use the following:

AIR FLOW REQUIRED TO SUPPLY HUMIDIFICATION LOAD



The air flow required to support the steam input with relative humidity levels R_1, and R_2 as shown is:

$$C = \frac{7000\ H}{60\ M_s\ (R_2 - R_1)}$$

Where H = Humidification load, LB of steam/hr.
M_s = Moisture content of air, saturated, GR/FT³
R_1, R_2 = Relative humidity levels (as a decimal)

CFM (AIR FLOW) REQUIRED FOR 1 LB/HR STEAM
WITH 90% R.H. DOWNSTREAM*

T TEMP. °F	M_S, GR/FT³	ENTERING R. H., %						
		20%	30%	40%	50%	60%	70%	60%
55	4.889	34	40	48	60	a0	119	239
60	5.795	29	34	40	50	67	101	201
65	6.345	24	28	34	43	57	85	170
70	8.055	21	24	29	36	48	72	145
75	9.448	18	21	25	31	41	62	123
80	11.04	15	18	21	26	35	53	106

*NOTE: This table is valid for DUCT SYSTEMS ONLY. It does not apply to open air stream systems (Models FSA, AMAF, EHF) where entrainment increases the effective air flow.

The recirculation system can be installed outside the computer room walls, (minimizing disruptions) or in the ceiling. In the same manner, an EHF fan package can be used to introduce noisture to the computer room. A through-the-wall mount is ideal for two reasons:

1 .Computer room floor space is at a premium and through the wall takes up no floor space.

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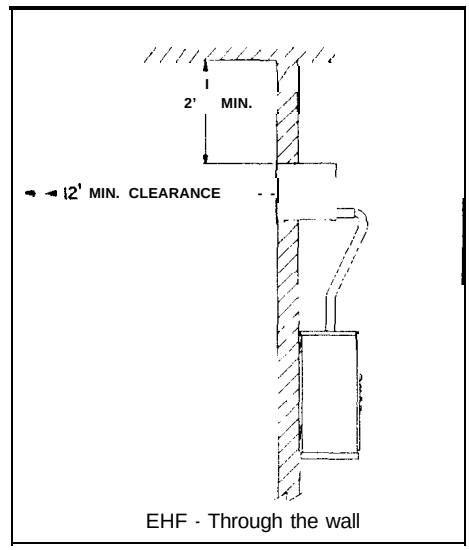
2. Since the humidifier is actually outside the room, maintenance can be performed without upsetting operations.



EHF - Through the wall

TWO IMPORTANT NOTES:

1. Because air conditioned computer rooms have cold air present in many locations, a discharge point of humidified air should be limited to 20#/hr to avoid fogging. For example - a lOO#/hr. humidifier recirculation system can be accomplished with a single fan and humidifier, but should break the discharge from the system into 5 branches and discharge points.

2. The magnitude of a computer room investment justifies redundant capacities on most support systems:

   a. Back-up humidifiers may be justified.
   b. High limit humidity controllers located in the room (set at 55% RH) also may be justified.

CONCLUSION

Computer rooms must be humidified mainly to prevent discharge of static electricity (also known as ESD). Many humidifiers installed in computer room air conditioners have been decommissioned because it's hard for the cold air to support the humidity and/or low reliability of the humidifier itself. To solve the problem, a high reliability humidifier can be installed in a recirculating air system (which avoids the cold air). These air systems can be ducted (for large rooms) or self contained. Proper sizing of the humidifier, proper selection of humidity set point, and good introduction of humidity into the space will make the computer and computer room run more smoothly and efficiently.

Recommended reading:

HEATING, PIPING & AIR CONDITIONING MAGAZINE
*April '85 Computer Room design - rethinking
*November '84 Computer Room humidity control
1987 ASHRAE HANDBOOK WAC SYSTEMS & APPLICATIONS
Chapter 33 - Data Processing System Areas
*Reprints available from Armstrong

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