

*Beyond
the
Numbers*

NATIONAL ARCHIVES AND RECORDS
ADMINISTRATION

20TH ANNUAL PRESERVATION CONFERENCE

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UNDERSTANDING MECHANICAL SYSTEMS THAT SUPPORT PRESERVATION ENVIRONMENTS

Ernest A. Conrad, PE, LEED AP

PRINCIPAL

LANDMARK FACILITIES GROUP, INC.

WWW.LFGINC.COM

BASIC RULES

- KNOW YOUR COLLECTION
- KNOW YOUR BUDGET

AGENDA

- BASICS
 - SPACE USE
 - SPACE ENVELOPE
 - COST
- SYSTEM CHOICE
- FILTRATION

SPACE USE











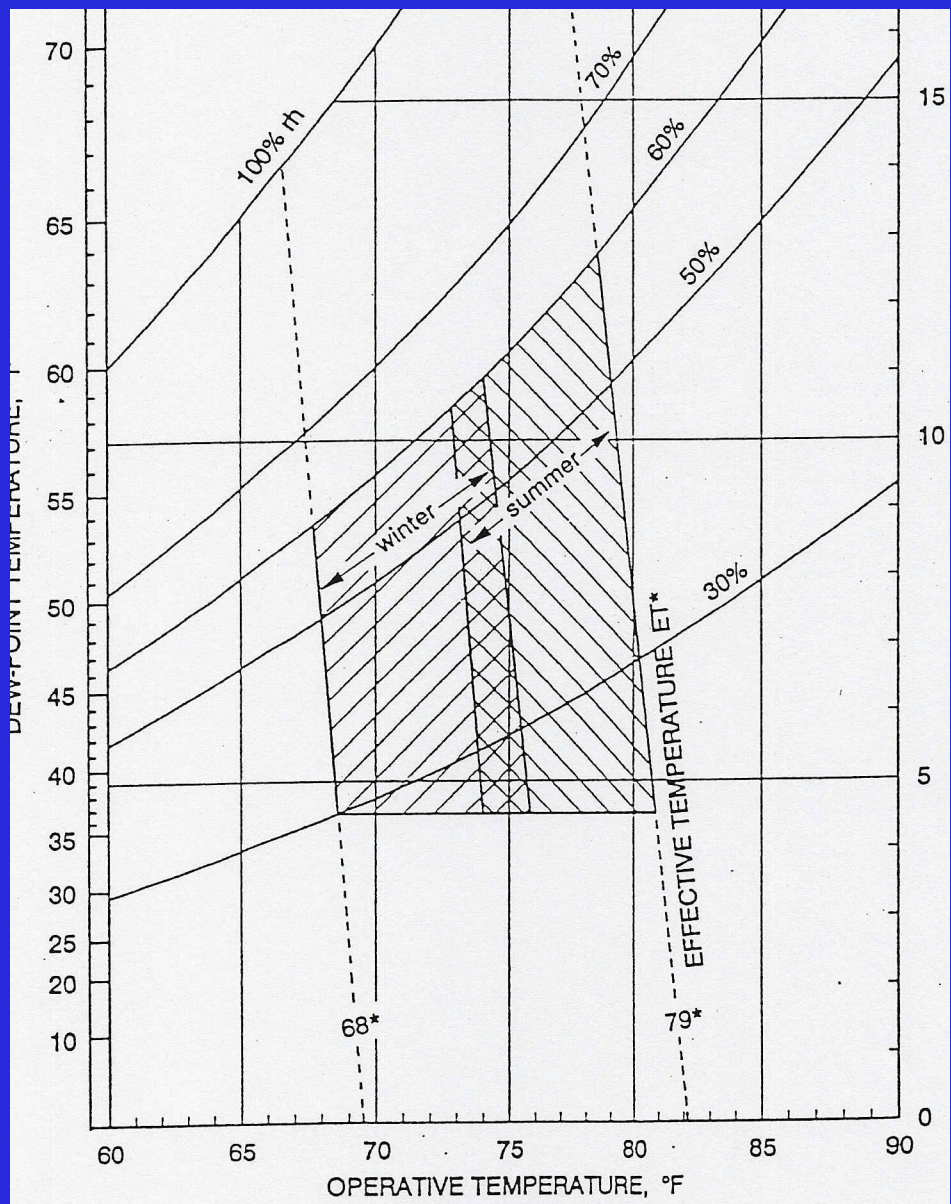


Fig. 5 Standard Effective Temperature and ASHRAE Comfort Zones

SPACE ENVELOPE

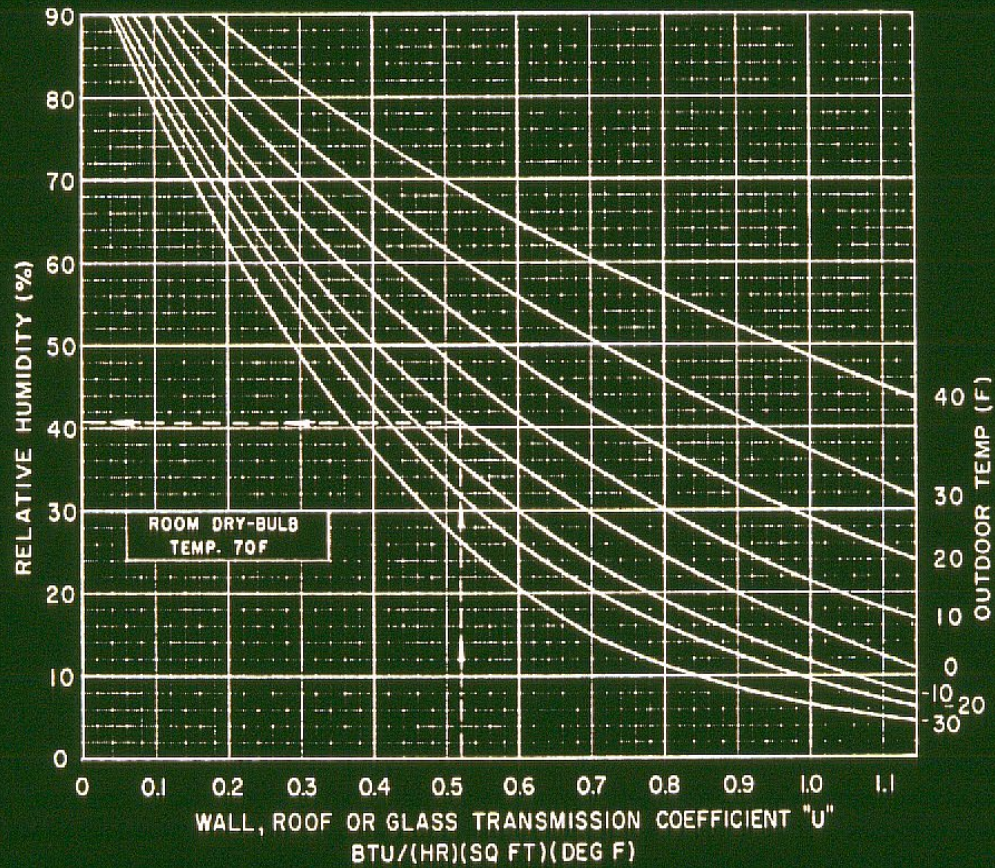




“U” Values of Materials

■ 10” concrete.....	.61
■ .75” wood.....	.58
■ 8” brick.....	.48
■ 12“ stone.....	.55
■ 8” concrete block.....	.52
■ Single glass.....	1.13
■ Double glass.....	.55
■ Triple glass.....	.36
■ 1” rigid foam board.....	.20

CHART 2—MAXIMUM ROOM RELATIVE HUMIDITY WITHOUT CONDENSATION
NO WALL, ROOF OR GLASS CONDENSATION



COSTS

FIRST COST BUDGET

- HEATING ONLY..... \$10 /sqft
- BASIC A/C.....\$25/sqft
- CLIMATE CONTROL.....\$50/sqft

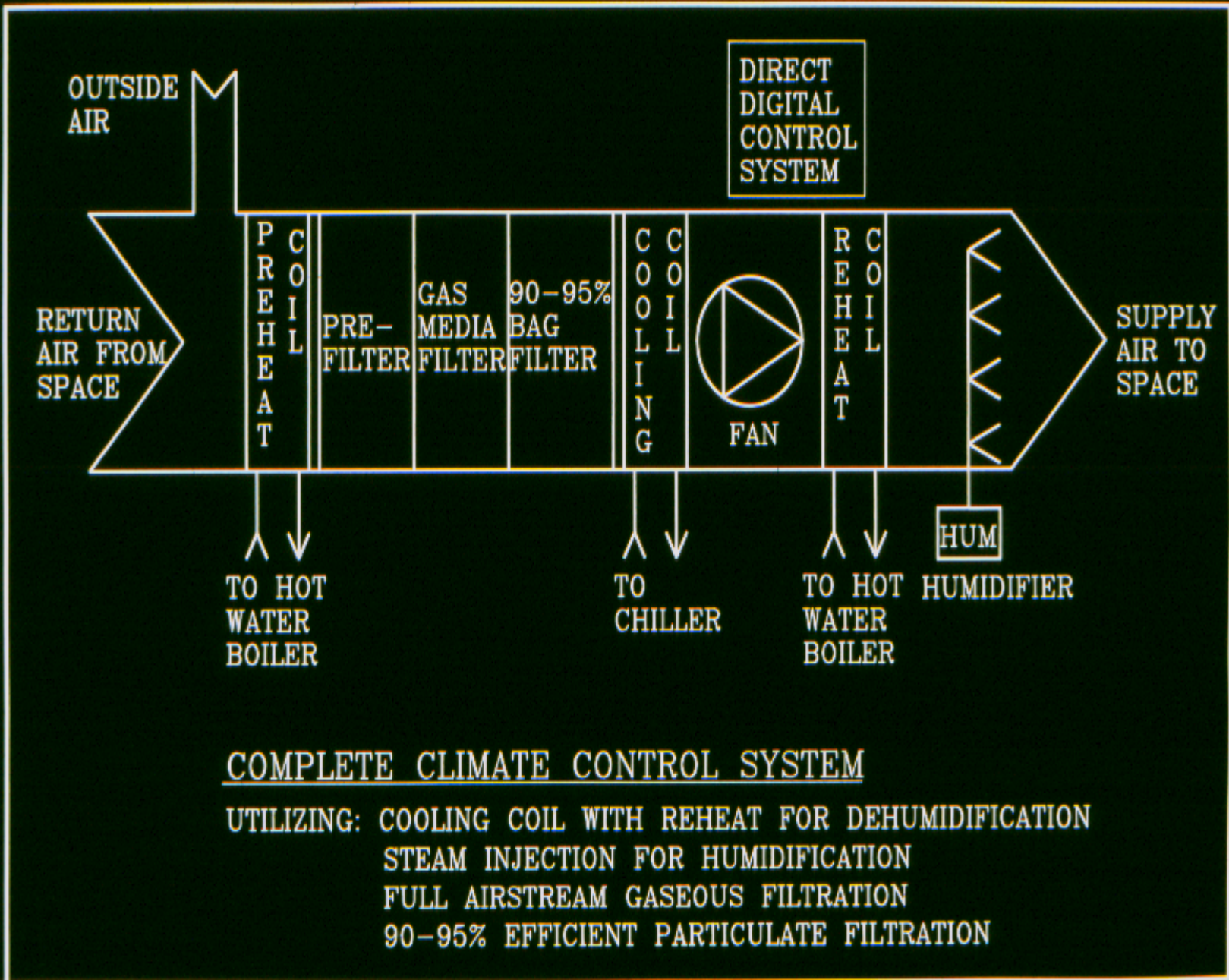
ENERGY COST BUDGET

- CHURCH.....\$0.75/sqft/yr
- HOUSE.....\$1.25/sqft/yr
- OFFICE.....\$1.75/sqft/yr
- MUSEUM.....\$3.00/sqft/yr

EQUIPMENT CAPABILITIES

WHAT IS CLIMATE CONTROL ?

- HEATING
- COOLING
- DEHUMIDIFICATION
- HUMIDIFICATION
- FILTRATION

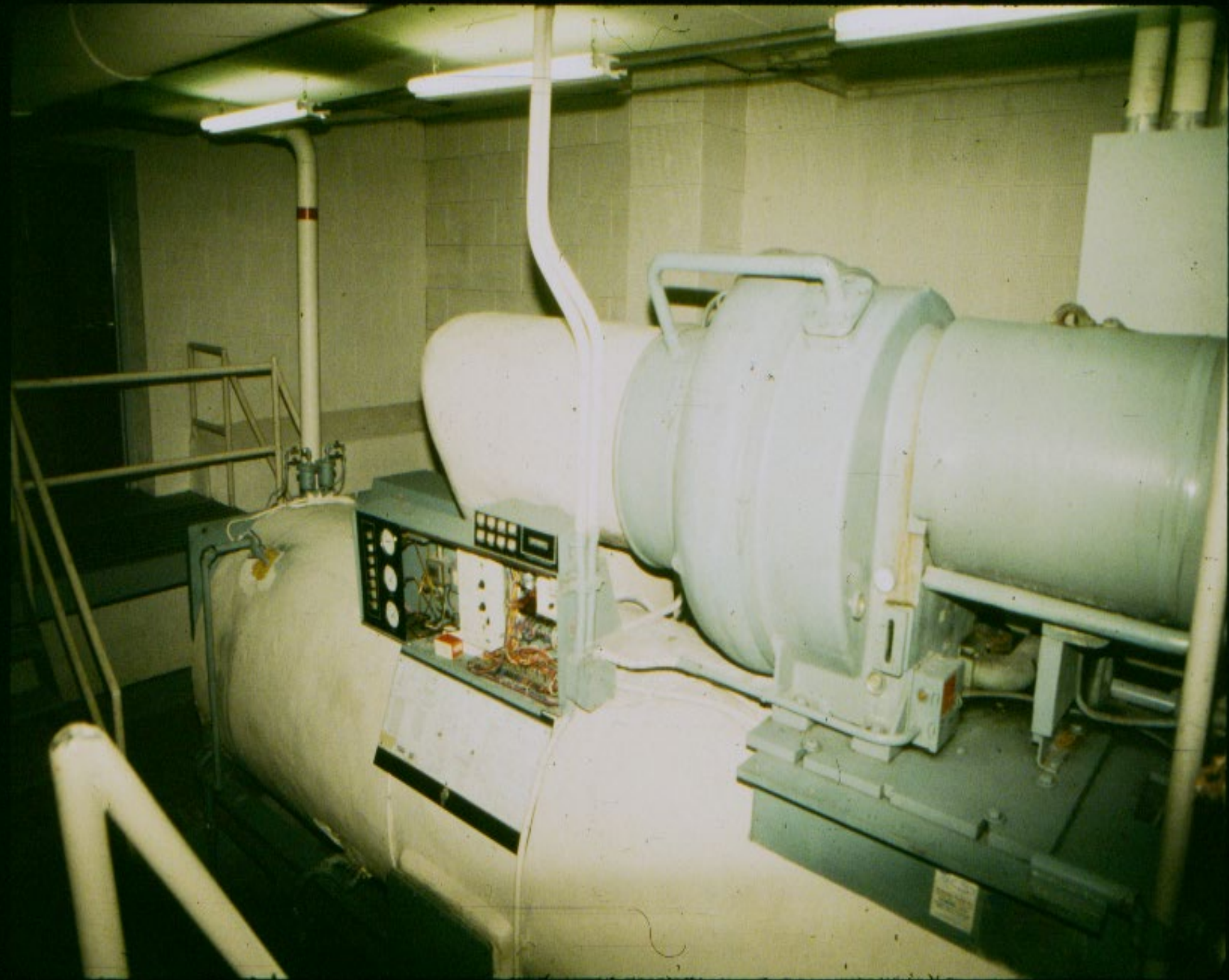


HEATING

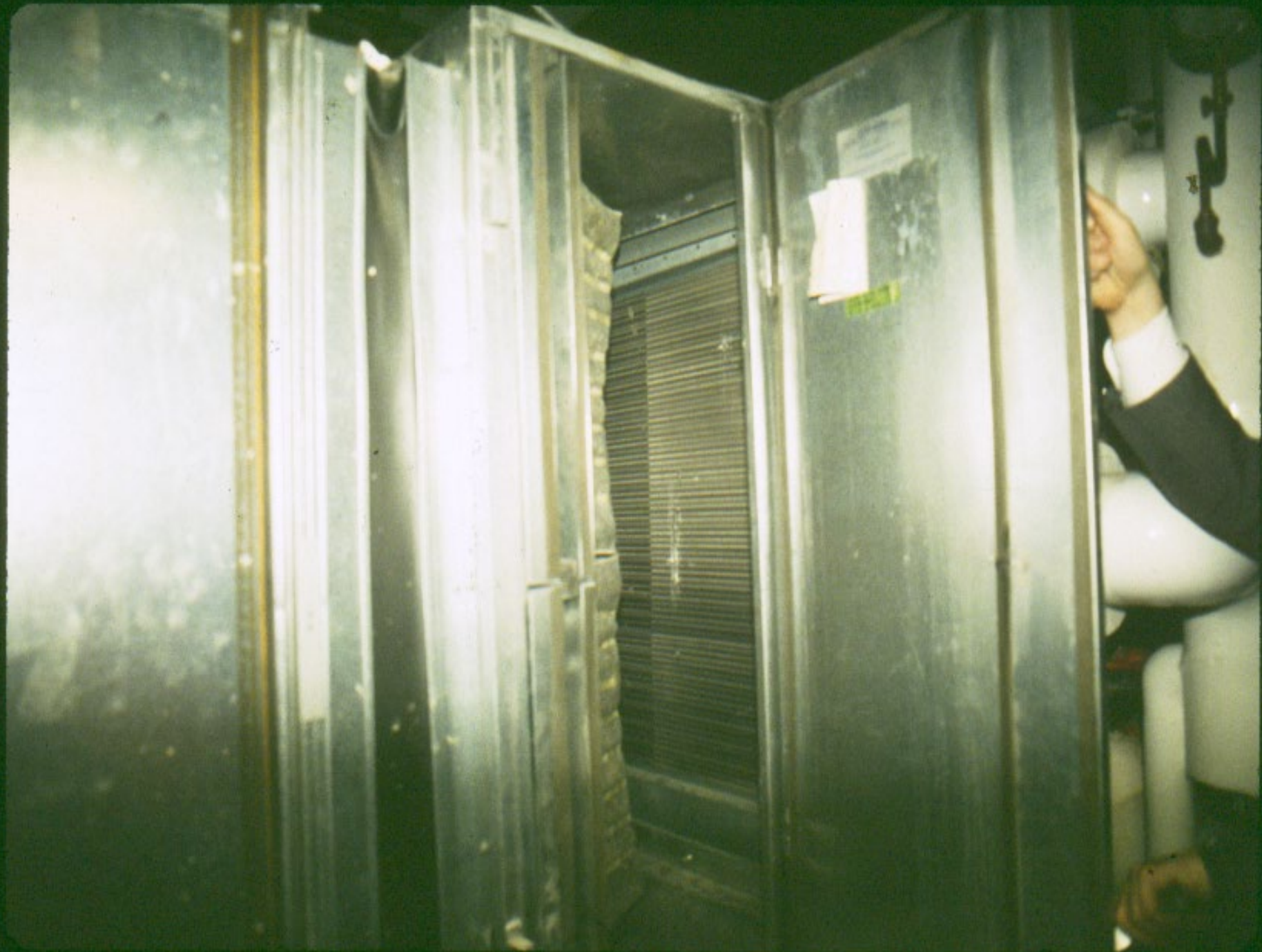
- ELECTRIC
- HOT WATER
- STEAM
- AVOID HOT AIR FURNACE

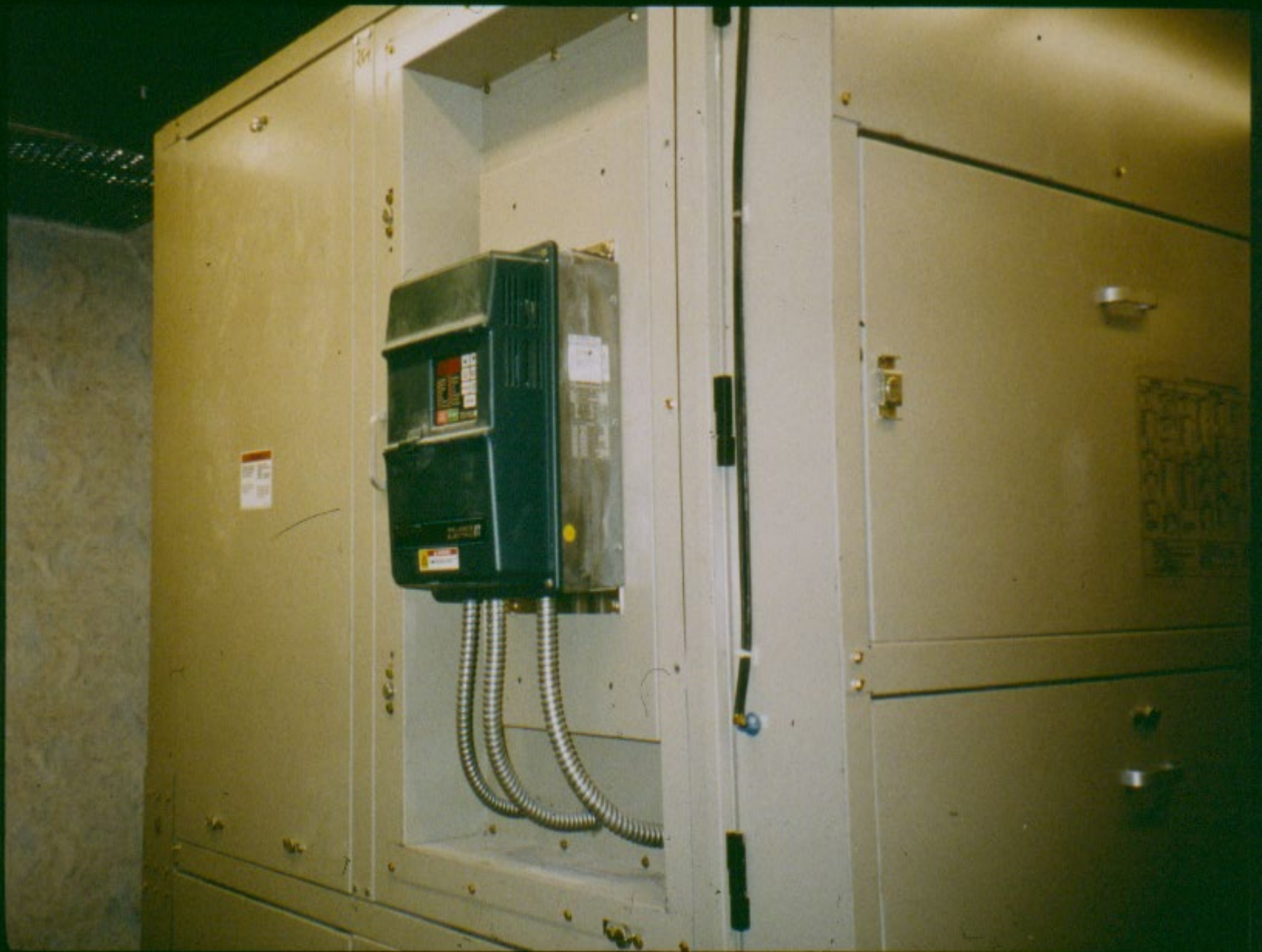
COOLING

- CHILLED WATER
- DIRECT EXPANSION (DX)
- SPECIAL SYSTEMS

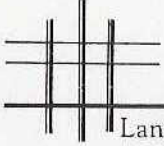








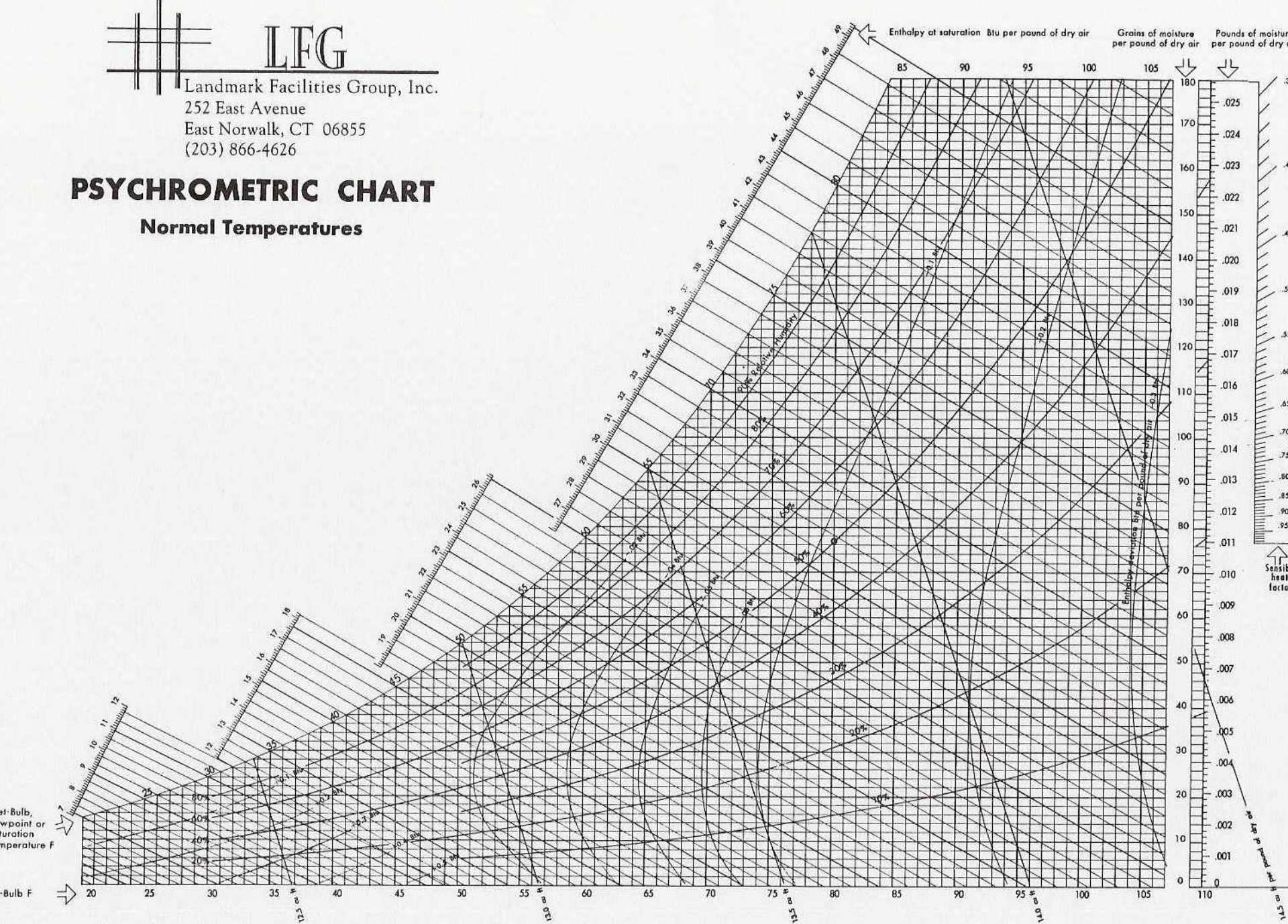




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Landmark Facilities Group, Inc.
252 East Avenue
East Norwalk, CT 06855
(203) 866-4626

PSYCHROMETRIC CHART Normal Temperatures



Below 32 F, properties and enthalpy deviation lines are for ice.



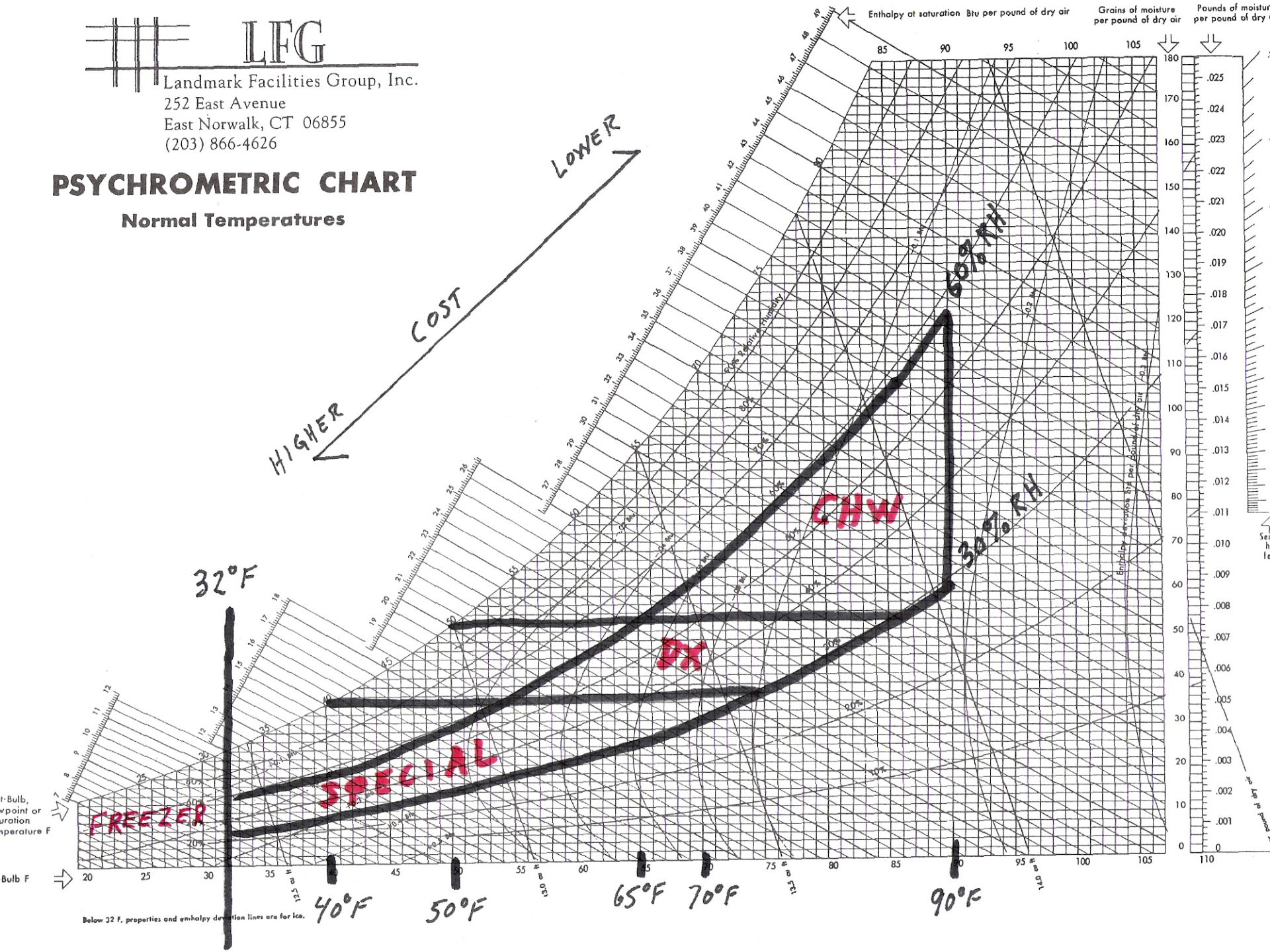
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PSYCHROMETRIC CHART

Normal Temperatures

HIGHER ←
LOWER →
COST



Below 32 F, properties and enthalpy deviation lines are for ice.

Wet-Bulb, Dewpoint or Saturation Temperature F
Dry-Bulb F

Grains of moisture per pound of dry air
Pounds of moisture per pound of dry air

DEHUMIDIFICATION

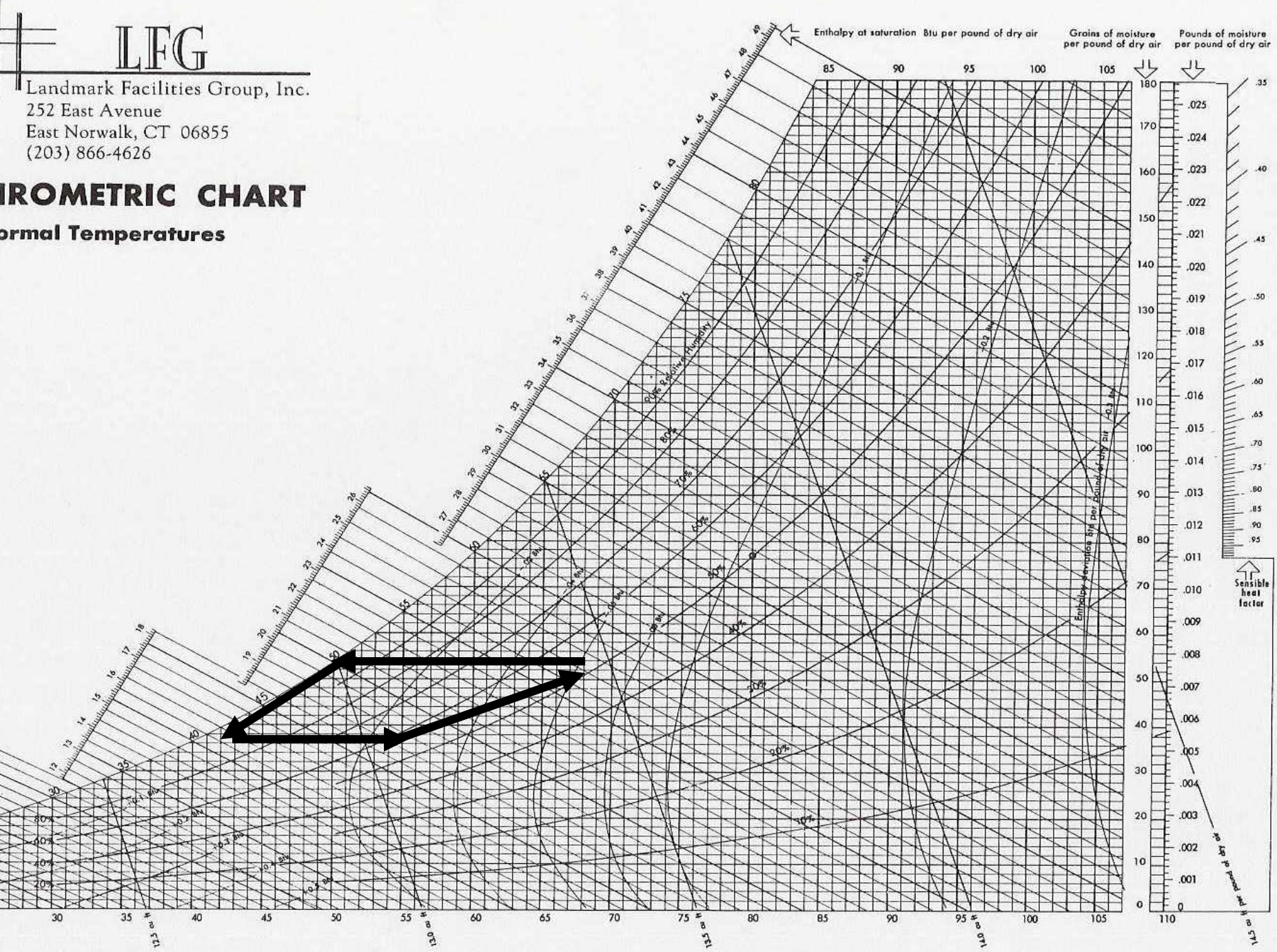
- COOLING & REHEAT
- DESICCANT ABSORPTION

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PSYCHROMETRIC CHART

Normal Temperatures



Enthalpy deviation lines are for ice.

HUMIDIFICATION

- DIRECT INJECTION STEAM
- WATER MIST SPRAY
- BOILING WATER VAPOR
- EVAPORATIVE SURFACE
- ULTRASONIC MIST

FILTRATION

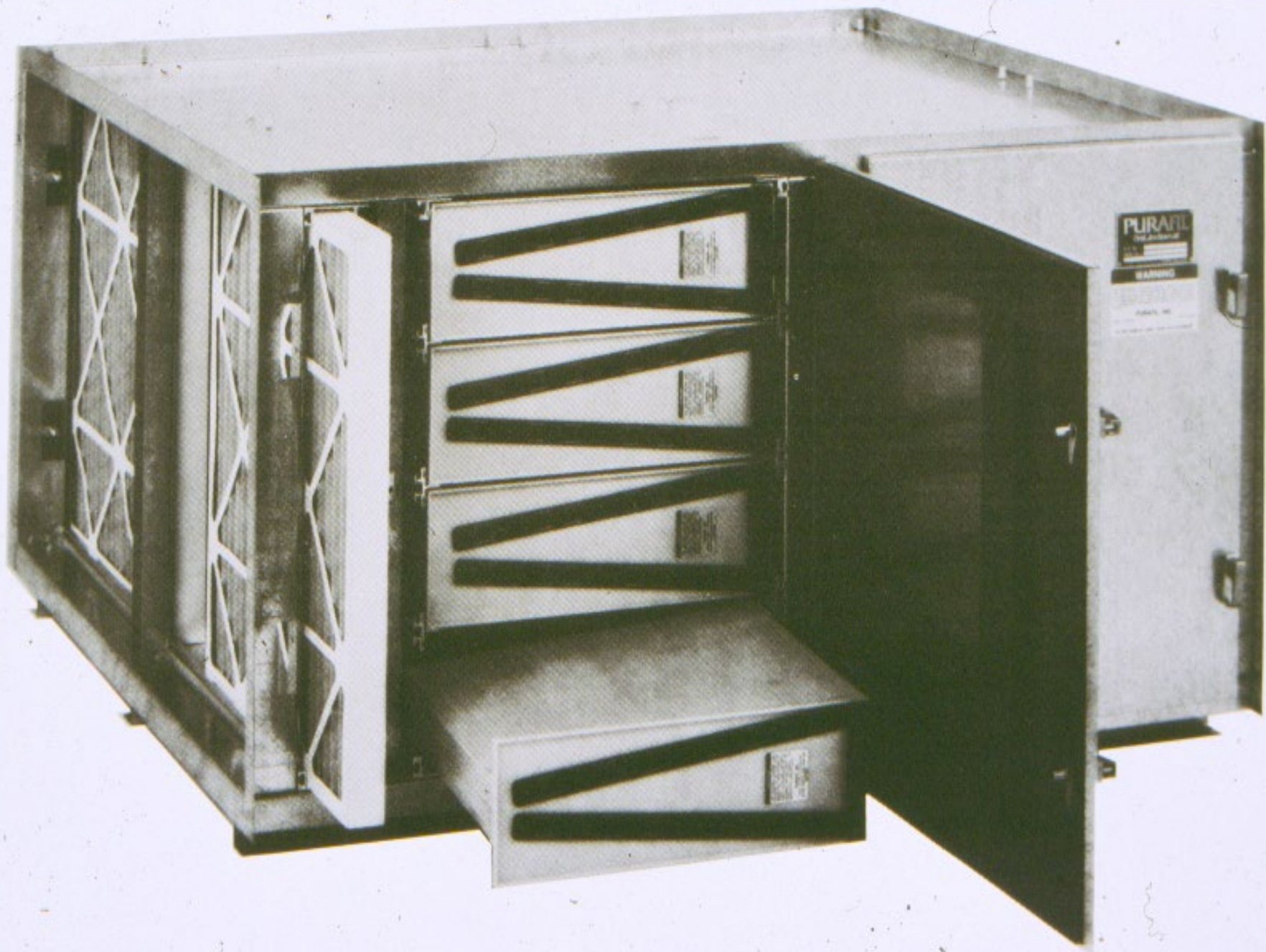
- PARTICULATE
- GASEOUS

F I L T R A T I O N E F F E C T I V E N E S S

MERV level	Dust spot, percent	Typical particulate-filter type	Percent 0.3 to 1.0 μm	Percent 1.0 to 3.0 μm	Percent 3.0 to 10.0 μm	
1	NA	Low-efficiency fiber-glass- and synthetic-media disposable panels, cleanable filters, and electrostatically charged media panels	Efficiency too low to be applicable to Standard 52.2 determination			
2	NA					
3	NA					
4	NA					
5	NA	Pleated filters, cartridge/cube filters, and disposable multidensity synthetic link panels			20 to 35	
6*	NA				36 to 50	
7	25 to 30				50 to 70	
8	30 to 35				Greater than 70	
9	40 to 45	Enhanced-media pleated filters, bag filters of either fiber-glass or synthetic media, and rigid box filters using <i>lofted or paper media</i>		Greater than 50	Greater than 85	
10	50 to 55			50 to 65	Greater than 85	
11	60 to 65			65 to 80	Greater than 85	
12	70 to 75			Greater than 80	Greater than 90	
13	80 to 85		Bag filters, rigid box filters, and minipleat cartridge filters	Greater than 75	Greater than 90	Greater than 90
14	90 to 95			75 to 85	Greater than 90	Greater than 90
15	Greater than 95	85 to 95		Greater than 90	Greater than 90	
16	98	Greater than 95		Greater than 95	Greater than 95	
The following classes are determined by a methodology different than that of ANSI/ASHRAE Standard 52.2-1999, <i>Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size</i>						
17	NA	High-efficiency-particulate-air/ultralow-penetration-air filters evaluated using Institute of Environmental Sciences and Technology (IEST) method of test. Types A through D yield efficiencies at 0.3 μm and Type F at 0.1 μm	99.97-percent IEST Type A			
18	NA		99.99-percent IEST Type C			
19	NA		99.999-percent IEST Type D			
20	NA		Greater than 99.999-percent IEST Type F			

*MERV 6 level prescribed by ANSI/ASHRAE Standard 62-2001, *Ventilation for Acceptable Indoor Air Quality*, for minimum protection of HVAC systems

TABLE 2. Comparison of MERV data, filter type, and prior designations.



*AND NOW WE ARE ALL
SMART ENOUGH TO BE
DANGEROUS !*