ATMOSPHERIC ENVIRONMENT

FOR

TELEPHONE EQUIPMENT SPACE

GENERAL CONSIDERATIONS AND HEAT RELEASE DATA

1. GENERAL

1.01 A number of Bell System Practices will be issued under the collective title of "Atmospheric Environment for Telephone Equipment Space" of which this is the first covering "General Considerations and Heat Release Data." Subsequent practices will pertain to other phases of conditioning the air.

1.02 The engineering objective in providing a controlled environment is to obtain improved equipment performance with reduced maintenance costs, offsetting in whole or part the annual charges for the control equipment.

1.03 These practices will cover the requirements for conditioning the air in terms of the degree of control necessary or economically warranted based on experience with existing types of central office equipment operating under varying environmental conditions. They will outline what is believed to be the most suitable means of providing the desired control for air distribution, air movement, atmospheric impurities, humidity and temperature when such control is indicated. It does not necessarily follow that all equipment space will require similar treatment since each location must be studied individually to determine the degree of control which can be economically provided as related to the savings which may be expected in maintenance from such an installation.

1.04 This practice is primarily intended to present engineering data which will be useful in the design of mechanical ventilating systems, with or without cooling, for attended central office equipment space such as dial switchrooms and the AMA space in which the tape processing equipment is located. It is not intended for application to unattended equipment space such as Community Dial Offices, Repeater Huts, Power Rooms and other plant equipment spaces. Also, it is not intended that this practice be applied to the problems of providing comfort air conditioning for Operating Rooms or general office space.

1.05 The "Heating-Ventilating-Air-Conditioning Guide" published by the American Society of Heating and Air Conditioning Engineers is suggested as a reference for additional technical data.

2. NEED FOR A CONTROLLED ENVIRONMENT

2.01 It is recommended that windows of equipment spaces be kept closed at all times to minimize the amount of dust in the outside air which might enter the switchrooms. Dust of a fibrous nature causes open contact troubles. That of an abrasive nature causes impairment of contact treatment; wear on base metal or other contacts; and wear on bearing surfaces. The latter is particularly important with respect to panel and step-by-step apparatus. With closed window operation, it is generally considered necessary for reasons of personal comfort, to install a ventilating system to provide fresh air in motion, to remove stagnant air and odors, and to remove heat generated by the equipment, lights, and personnel. These conditions relate principally to warm weather operation, yet some ventilation is required during cold weather. Ventilation with outside air may adversely affect central office equipment performance as a result of both its dust and moisture content unless precautions are taken to control these conditions within the ventilating system.

2.02 Dial apparatus is designed to operate satisfactorily at room ambient temperatures up to 130°F. Generally, any apparatus which generates enough heat to affect its operation is equipped with a blower to disperse this heat into the room. With this arrangement, room ambient temperatures will rarely exceed 130° F if mechanical ventilation, without cooling, is provided.

2.03 Extreme variations in relative humidity affect the performance of dial equipment because of dimensional changes of nonmetallic materials such as phenol fiber and phenol fabric, paper insulation of panel multiple banks, and cork on panel drive rolls. Under the worst

conditions, adjustments are unstable and maintenance effort is increased. Wintertime humidity control minimizes the electrostatic attraction of the dust particles to contact springs and wiring. The latest types of dial apparatus are less subject to adjustment instability and perform more satisfactorily under varying humidity conditions than apparatus used in older dial systems.

2.04 Variations in relative humidity also affect the paper tapes processed in AMA centers. It is suggested that the space occupied by the AMA tape processing equipment be air conditioned with cooling and humidity control in accordance with the design data set forth in Paragraph 3.02(b) and (c).

3. DESIGN OBJECTIVE

3.01 The following engineering criteria are recommended for the design of ventilating systems intended to control the environment in attended central office and AMA center space.

3.02 Temperature and Humidity Control

(a) Summer - Ventilation Only - Maintain a room condition with a maximum of 10° F above the maximum design dry bulb temperature as listed for various localities in the A.S.H. & A.E. "Guide." When room conditions exceed 65 per cent relative humidity, automatically control the ventilating system to deliver a maximum of recirculated air. This will tend to reduce the relative humidity within the room thereby minimizing the detrimental effects which extreme variations in relative humidity have upon switching equipment.

(b) Summer - Ventilation with Cooling - Maintain a room condition having a maximum of 55 per cent relative humidity. To maintain room conditions lower than 55 per cent relative humidity will substantially increase the cost of the refrigeration equipment and operating costs disproportionately to the benefits realized. Maintain a room temperature not lower than 13° F below the maximum design dry bulb temperature as listed for various localities in the A.S.H. & A.E. "Guide." However, a reduced temperature differential is recommended for the lower outside temperatures. Cool air supplied to the room should not be more than 18o to 20° F below the room dry bulb temperature.

(c) Winter - Maintain approximately 35 per cent relative humidity in central office and AMA center spaces. A gradual reduction in relative humidity for short periods of time may be advisable to minimize window condensation as the outside temperatures fall. Double glazing may be helpful in reducing condensation in colder climates.

3.03 Filtration: Research conducted by the Bell Telephone Laboratories indicates that 4 inches of KS-7406 glass wool filter media are adequate to minimize open contact equipment troubles due to dust. The four inches of media are obtained by placing two KS-7406 glass wool filters, each 2 inches thick, in tandem in the filter frame. The second filter will remove approximately 25 per cent of the dust by weight which passes the first filter. Standard household type filters are not recommended. The KS-7406 filter has a graduated pack coated with an adhesive oil which makes these filters more efficient. When the filters require servicing, the filter unit on the dirty air side is discarded, the second filter is moved forward and a new filter installed on the clean air side. More efficient filters may be desirable in areas where the air is contaminated with large quantities of fine dust particles. Generally, electric type filters are not required except for a few locations having extremely large dust concentrations in the air.

3.04 Ventilating Systems - With or Without Cooling: Mechanical ventilation provides a filtered air supply for apparatus areas when closed window operation is practiced. The choice of a large air volume ventilating system or a smaller air volume system with cooling will depend upon a comparison of first costs, operating expenses, and maintenance costs. Without cooling, 8 to 12 air changes per hour may be required to meet the design limits outlined in Paragraph 3.02(a). With cooling, approximately 4-1/2 or 5 air changes per hour will usually meet the limits of Paragraph 3.02(b). Concentrations of high heat producing equipment may require more air changes than indicated for either type of system. Most ventilating systems are designed to deliver a mixture of recirculated and outside air in varying proportions. Since the greatest percentage of dust removed by air filters is dust in the outside air, maintenance costs for filter changes will be reduced if the volume of outside air handled by a system is kept at a minimum consistent with local building and health codes. Systems with cooling generally provide up to 25 per cent of their capacity as outside air. More, up to 100 per cent, may be desirable at certain seasons to reduce the operating costs for the cooling equipment; however, filter maintenance would increase. The handling of larger air volumes requires a greater number of filters and larger

duct sizes for air distribution. Low face velocities for air discharge diffusers tend to reduce dust impingement on near-by apparatus.

4. EQUIPMENT HEAT RELEASED

4.01 The average heat released by various types of central office and AMA equipment is listed below. Other information relative to the heating or cooling load needed in the design of ventilating systems may be found in the A.S.H. & A.E. "Guide."

	Watts per Sq Ft of Floor Space
Step-by-Step System	.75 (1) (4) (7)
Panel System	1.25 (1) (4)
Local Crossbar Systems	1.35 (1) (4) (7)
Crossbar Tandem Systems	2.00 (1) (4) (7)
Toll Crossbar Systems	2.50 (1) (2) (4) (7)
Large Repeater Station	3.00 (1) (3) (4)
AMA Accounting Centers Equipment	4.00 (5)

Equipment	Watts per Unit	Watts per Bay (4) (6)
N-1 Carrier	350 per Term.	1050
O-1 Carrier	150 per Term.	600
O or N Thru Channel Unit	Deduct 11 watts per channel unit	
ON Junction Equipment	48 per Group	336 Max
E2 Repeater	3.8	23-inch Bay 570 Max
E3 Repeater	3.4	23-inch Bay 510 Max
2400-2600 Cycle SF	18	540
43A Telegraph		Max / Min
Channel Term. Nonserv. Board	24	764 / 468
Channel Term. Service Board	30	870 / 735
Loop Pad (Avg)	10	- / -
Filament Pot	5	- / -
96A1 Telegraph Loop Repeater	24	Max of 36 per Bay 870 Watts
144-Type Coupling Units		
144A1	15	40 Max per Bay 600
144B1	20	40 Max per Bay 800
144C1	20	40 Max per Bay 800
143A2 Regenerative Repeater	32	30 Max per Bay 960 With Filament Pots 1110

(1) Average watts per square foot per hour of switchroom space based on a 24-hour period.

(2) 2.50 watts per square foot for toll crossbar systems includes a concentration of 17 watts per square foot in the card translator area. Special attention is required for card translators. If partitioned off from the toll switchroom, deduct the following watts from the switchroom space and treat both the switchroom and enclosed area accordingly.

Home translator - 1000 watts per translator per hour.
Foreign Area Translator - 600 watts per translator per hour.
Emergency Translator - This is a substitute for either type of translator. It is only used when either a Home or Foreign Area Translator has failed. Hence, the Emergency Translator does not affect the total heat released by this type of equipment.

(3) May vary from 2 to 15 watts depending on type of equipment.

(4) Add heat released by lights, an average value of which might be one watt per sq ft. However, the heat released by lights may vary depending upon the light intensity engineered for the space.

(5) Heat released only when the AMA equipment is operated during working hours. Add heat released by lights which may vary depending upon the light intensity engineered for the space.

(6) Recommended maximum watts per bay of equipment when equipment layout is based on minimum aisle widths. This does not include the heat generated by lighting.

(7) Recommended maximum watts per square foot of floor space when equipment layout is based on a 20' by 20' building bay. If something other than a 20' by 20' building bay is used for the layout of the identical telephone equipment, multiply the watts by the ratio of the area of the 20' by 20' building bay to the area of the building bay used.