ATMOSPHERIC ENVIRONMENT
FOR
TELEPHONE EQUIPMENT SPACE
GENERAL CONSIDERATIONS AND HEAT RELEASE DATA

1. GENERAL

1.01 This section, as the title indicates, is general in nature because of the multiple combinations of present-day equipment. The heat release data does not list every component capable of giving off heat in an equipment space. The approach to air conditioning for heat release is varied, dependent upon climatic and geographical conditions.

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

1.03 It is not intended that this section be applied to the problems of providing comfort air conditioning for personnel.

1.04 This section will cover the recommendations 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. It 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.

1.05 This section 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.

1.06 The ASHRAE Guide and Data Book published by the American Society of Heating, Refrigerating, and Air Conditioning Engineers is suggested as a reference for additional technical data.

1.07 Specific heat release data for various types of telephone equipment will be made known by issuing supplementing sections to this section. Each supplementing section will reflect an updated source of information regarding heat release data currently available.

1.08 During the period required to issue and distribute a supplementing section regarding specific heat release data, it is recommended that the Building Engineer consult with the Equipment, Power, Radio, or Transmission Engineer for the latest current drain data. A continuing liaison between the Building Engineer and those Equipment Engineers familiar with current and heat dissipation has proven worthwhile and is recommended.

1.09 This section is issued and cancels Section 760-550-150. Atmospheric Environment for Telephone Equipment Space – General Considerations and Heat Release Data.

1.10 Arrows are not used because of extensive changes in the text.

2. DESIGN OBJECTIVES

2.01 The following engineering criteria are recommended for the design of systems intended to control the environment in equipment spaces.

2.02 Relative Humidity Control

(a) Where control is necessary, it is recommended that relative humidity be maintained between 45 percent and 55 percent in the warm months and 30 percent and 35 percent in the cold months, when outside conditions permit.

(b) If the relative humidity rises above 55 percent and approaches 65 percent, the ventilation equipment, if available, should gradually go to the recirculation condition to keep the introduction of outside air to a minimum. If the relative humidity continues to rise, the dampers should be manually positioned, to achieve complete recirculation, or the system should be shut off.

(c) In order to maintain the relative humidity in equipment space above the recommended minimum (see Section 760-555-151), it may be necessary to add moisture to the ventilation air by a spray system, direct steam, or vaporizing pan. Spray systems can provide adequate control, especially if the water and ventilation air are heated. Waste spray water should be drained to the sewer rather than recirculated, because of concentration of solids in that which is retained. Filters may be provided after the humidifying sprays, to prevent suspended solids from coating ductwork and entering the equipment space, if this is a problem.

(d) If steam is available, it is the most responsive means for adding moisture to the ventilation air. A steam grid humidifier can be used in ductwork or in the space. Steam should not be used for humidification if the boiler water is being treated with volatile amines or sodium nitrite. Ductwork which may be wet by steam should be stainless steel or some similar corrosion-resistant material.

(e) Pan-type humidifiers, using hot water or steam coils, are another means of adding moisture to the ventilation air and are generally not to be recommended, because of lack of adequate capacity and control and the difficulty of maintenance, especially in hard water locations.

(f) If the outside temperature drops below 30°F and there are single-glazed windows in the equipment space, it may be desirable to lower the relative humidity to prevent condensation of moisture on the windows. Maximum inside relative humidities allowable without the appearance of moisture on single-glazed windows with inside air temperature at 70°F are as follows:

O.A. TEMP. (°F)	R.H. (%)	O.A. TEMP. (°F)	R.H. (%)
40	48	0	15
30	37	-10	11
20	28	-20	7
10	21	-30	5

(g) Higher dry-bulb (room) temperatures at the same relative humidities will result in condensation forming on the windows at higher outside temperatures. Double-glazing of windows allows inside conditions of 70°F and 30 percent relative humidity at 30°F without condensation appearing.

2.03 Filtration Requirements

(a) ***General***

The filtering of air supplied to telephone equipment space is desirable from the viewpoint of equipment performance. The KS-7406 air filter media is designed for primary air filtration in air conditioning and/or ventilating systems in Bell System central offices and buildings located in predominantly open or rural areas where airborne dusts have a relatively large particle size and air pollution is not a serious problem. In other locations, the KS-7406 air filter media should be used as a prefilter for medium or high efficiency filters. Generally, electrostatic-type filters are not required except for a few locations having extremely large dust concentrations in the air. Package units providing

only one inch of filtering should not be used to filter outside air directly but can be used in a recirculatory design. Environment of the equipment building will of course be a factor in the filtration needed. (See Section 760-555-151.)

KS-7406 air filter media can only be purchased through Western Electric Co. and are manufactured to comply with performance specifications established by Bell Telephone Laboratories. To insure conformance to the specifications, filters are inspected at the source of supply by the Western Electric Co. Because of this control of quality, it is strongly recommended that no substitution be made from local suppliers.

(b) ***KS-7406 List Numbers***

The KS-7406 classification includes four types of air filters. Each type is designated by a different list number. A description of the filter associated with each list number is as follows:

KS-7406 List 1

This is an air filter media in a replaceable cell-type frame measuring 19-1/2-inches by 19-1/2-inches by 2-inches. It is intended for use in installations adapted for a 19-1/2-inches by 19-1/2-inches by 2-inches, impingement-type, "industrial throw-away" air filter. This filter should be ordered as: Filter, Air, KS-7406 L1.

KS-7406 List 2

This is an air filter media in a replaceable cell-type frame, similar to List 1, except that the dimensions, other than thickness, are variable. It is intended for use in installations using impingement-type, "industrial throw-away" air filters of different dimensions than List 1.

This filter should be ordered as:

Filter, Air, KS-7406 L2 (specify length and width)

KS-7406 List 3

This is a synthetic media furnished in a replaceable blanket form which is installed in a permanently mounted locking frame. The framing system for holding the filter media may be in a flat or "V" bank-type configuration. The portion of the media containing an adhesive or tackifier is colored or marked to indicate the direction of airflow through the media. The media is available in 45 ft. rolls; 40, 42, 48, or 51 inches in width.

This filter should be ordered as:

Filter, Air, KS-7406 L3 (specify width)

KS-7406 List 4

This type air filter media is furnished as a roll-type blanket for use in manual or automatic roll-type air filter installations. This media is available in 65 ft. rolls in 3, 4, or 5 foot widths.

This filter should be ordered as:

Filter, Air, KS-7406 L4 (specify width only)

(c) ***Selection of Filters***

The selection of the type KS-7406 filter to be used should be based on economics from a first and continuing cost viewpoint as well as performance. Consideration must be given to the initial resistance of the filter, length of life in service, labor involved for maintenance, ease of handling, filter storage, etc.

There is no single criterion or set of criteria which is universally applicable to the selection of air filter media for all Bell System locations. Airborne dusts vary widely with respect to their particle size distribution, concentration, soiling properties, absorbed corrosive chemicals or gases, tendencies to absorb moisture, and adherence to surfaces. The KS-7406 filter is very effective against the larger sized particles over 5 to 10 microns in diameter. However, dusts having large amounts of fine sooty or oily particles (0.3 to 5.0 microns) require more efficient filters for adequate filtration.

When selecting a filter media, consideration must be given to the type of telephone switching equipment which is to be protected. Switching systems having sliding base metal contacts such as panel or step by step are more tolerant to dusts and contamination films than equipment having precious metal contacts with very little sliding action as in crossbar or wire spring relay installations. Newer types of equipment involving smaller contacts, less contact force, and very low voltages and currents such as are found in electronic switching systems using solid state circuits are more sensitive to fine dusts. Data tape machines are particularly vulnerable.

It is impossible to set rigid values on these factors that determine the exact requirements for every building operation. As previously mentioned, the KS-7406 air filter is designed for primary air filtration. Therefore, it is strongly recommended that medium efficiency air filter systems be installed with KS-7406 used as a prefilter, except in areas having airborne dusts with relatively large particle size and air pollution is not a serious problem.

Examples of acceptable filter arrangements are as follows:

1. Areas using KS-7406 as primary air filter

   a. Double layer of L1 or L2
   b. Single layer of L3
   c. Single layer of L4 and single layer of L1 or L2

2. All other locations using KS-7406 as a prefilter:

   a. Single layer of L1 or L2 and medium efficiency filter
   b. Single layer of L3 and medium efficiency filter
   c. Single layer of L4 and medium efficiency filter

Drawings showing these arrangements are as follows: Page 5

In locations using just the KS-7406 or the combination of KS-7406 and medium efficiency filters, the systems should be engineered for a face velocity of 360 feet per minute on the KS-7406 clean filter medium.

Additional information on the engineering and maintenance of air filters for use in building ventilation and/or air conditioning systems can be found in E.M. 1160, P.M. 73 dated April 10, 1969 and Section 770-220-201, Issue 3.

2.04 Ventilation Requirements

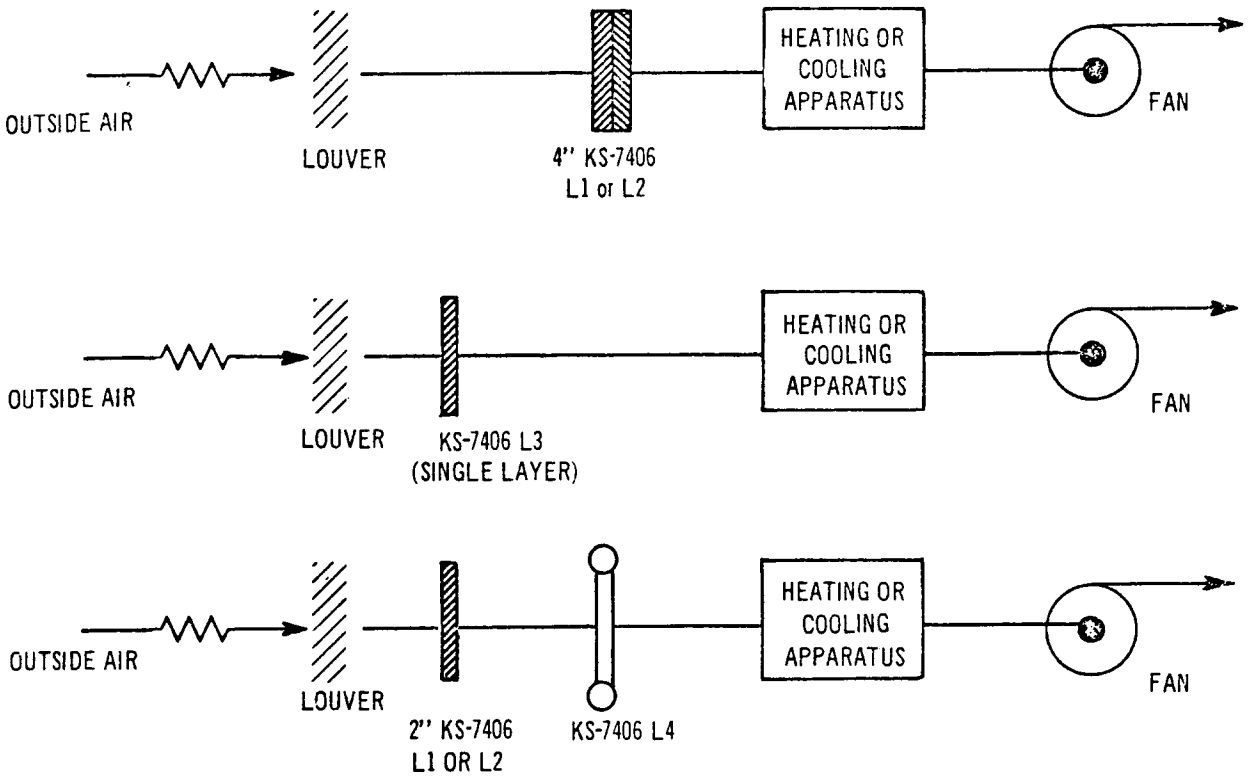
(a) Ventilation of equipment spaces is necessary, in order to control the ambient conditions within the recommended temperature and humidity operating ranges. In addition, ventilation may be needed if air distribution, movement, and odor control are desired.

(b) Small unattended offices normally can be ventilated adequately with exhaust fans.

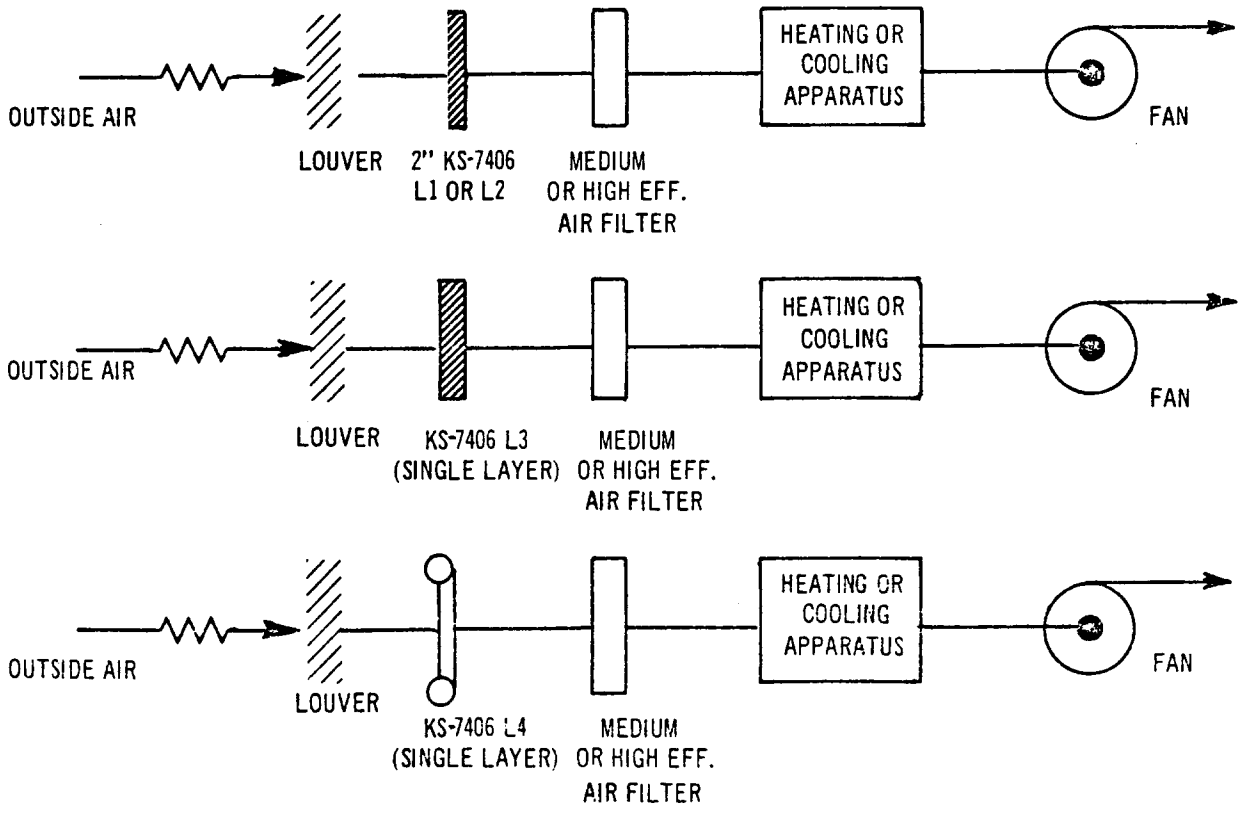
(c) Large attended offices should use a central ventilating system complete with supply and exhaust fans, ductwork, heating coils, filters, etc, to provide the air quantities needed to maintain the space temperature within the recommended operating range. Window ventilation should not be used, because of the dirt problems encountered. In fact, with the ventilation system, the equipment spaces should be maintained at a higher pressure than the spaces surrounding it so that unnecessary amounts of dust and dirt are not drawn into the space. Windows in equipment space are to remain closed at all times.

(d) Local or state codes shall be followed with respect to fresh air requirements. These may normally vary from 5 percent up to 25 percent of the total air movement provided by the system. If there are no local or state requirements, the system should be designed for a minimum fresh air quantity of 5 percent of that circulated. The ventilation system should be able to provide 100 percent outside air to the building and should also be able to recirculate completely under manual control.

KS-7406 USED AS PRIMARY AIR FILTER



KS-7406 USED AS PRE-FILTER



(e) In order to maintain the relative humidity below the recommended maximum, the ventilation equipment should be able to gradually move to the maximum recirculation position when the relative humidity in the space rises. If the humidity continues to rise, the dampers should be so arranged manually that complete recirculation is achieved. In most locations, upper temperature and humidity limits will not be exceeded at the same time.

(f) Air movement within space occupied by electronic switching equipment is essential to keep room ambient temperatures within the recommended ranges. To insure continuous air supply, serious consideration should be given to using two small supply fans in place of one large supply fan to electronic switching equipment areas. If each fan has the capacity to handle 50 to 75 percent of the total CFM required for the space, the loss of one fan would not eliminate all air movement.

(g) Air distribution systems for central office switching equipment space should favor high heat producing areas of the office. Higher than normal air velocities may be required in these high heat areas to keep room ambient temperatures compatible with other office areas. To insure good air movement in the areas of high heat dissipating equipment, a direct return duct system is recommended.

2.05 Cooling

(a) Some locations may not be able to maintain space conditions within the temperature and humidity limits set forth, without the provision of a cooling or refrigerating system.

(b) Some of the design considerations for equipment space cooling systems are as follows:

(1) Equipment space dry-bulb temperature should be 75 to 78°F.

(2) Cooling equipment should be designed using the principle required for comfort-cooling installation. With the heat generated by the equipment there should be few, if any, circumstances where 55 percent relative humidity would be exceeded.

2.06 Emergency Operation

(a) With higher cooling loads being experienced, some concern is to be shown regarding adequate dissipation of heat generated by the equipment if commercial power is lost for any appreciable length of time.

(b) The short-term maximum allowable room ambient temperature for the equipment (see Section 760-555-151) should not be exceeded. If the equipment space temperature is normally maintained within the recommended range by an air-conditioning and/or ventilating system, the maximum allowable temperature will not be exceeded during power failure if the following conditions are met:

(1) The emergency source of power is available and in operating condition.

(2) The ventilation system is able to operate. This requires that the source of emergency power is sized to handle this load in addition to telephone power requirements.

(3) The ventilation system can be operated to handle 100 percent outside air, and the air quantity moved (CFM) remains approximately the same as during normal operation.

(4) The outside summer design temperature plus the normal temperature rise in the equipment do not exceed the maximum allowable temperature in the equipment space.

(5) The outside temperature does not exceed the summer outside design temperature at the time of the power failure.

If the above requirements cannot be met with ventilation alone, it will then be necessary to size the emergency power equipment to have capacity for part of the cooling equipment as

required. I.E. Refrigeration equipment ***should not*** be connected to emergency power sources unless local design conditions are such that short-term maximum allowable room ambient temperatures will be exceeded with use of 100 percent outside air.

2.07 General Heat Release Notes

	WATTS PER SQ. FT. OF FLOOR SPACE					
Step-by-Step System	.75	(1)	(4)	(6)	(7)	
Panel System	1.25	(1)	(4)	(6)		
Local Crossbar Systems	2.00	(1)	(4)	(6)	(7)	
Crossbar Tandem Systems	2.50	(1)	(4)	(6)	(7)	
Toll Crossbar Systems	3.00	(1)	(2)	(6)	(4)	(7)
Large Repeater Station	3.50	(1)	(3)	(6)	(4)	
AMA Accounting Centers Equipment	4.50	(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

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

(2) Three 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, treat both the switchroom and enclosed area accordingly.

Home Translator – 1000 watts per translator.

Foreign Area Translator – 600 watts per translator.

Emergency Translator – This is a substitute for either type of translator. It is used only 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.

Remaining switchroom space – Two watts per square foot.

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

(4) Add heat released by room lighting, an average value of which might be two watts per sq. ft. However, the heat released by room lighting may vary, depending on 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 on the light intensity engineered for the space.

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