AIR FILTERS

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1. GENERAL

1.01 This section lists and discusses standards for air filtration in heating, ventilating and air-conditioning systems installed in Southwestern Bell buildings.

1.02 This section is being issued to replace and cancel Addendum 770-220-301SW. Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

2. DESCRIPTION

TYPE OF FILTERS

2.01 Air filters are classified into three categories:

Category I - Primary Filters
Category II - Medium Efficiency Type Filters
Category III - High Efficiency Type Filters.

A. Category I

2.02 Primary Filters: The standard primary filter is an inexpensive device that will remove large particles from the air supply effectively. The ASHRAE (American Society for Heating, Refrigerating and Air Conditioning Engineers) dust spot efficiencies for these filters range from 8 to 15 percent. The standard Category I filter used in the Bell System is the KS-7406. The detailed specification for KS-7406 is described in Section 770-220-301, paragraph 2.01.

B. Category II

2.03 Medium Efficiency Filters: There are two versions of intermediate or medium efficiency filters in general usage.

(a) The first is a pleated media filter which comes in standard sizes. In cases where the KS-7406 filter is not adequate and the expense of installing a system for a higher efficiency system is not justified, the pleated media filters will be advantageous. The pleated filters are somewhat more expensive than primary (Category I) filters, but they cost less than other medium and high efficiency filters that would require new holding frame installations as well. Note that pleated media filters are normally used without prefilters.

(b) The second kind of medium efficiency filter comprise those filters which have ASHRAE dust spot efficiency rating of 25 to 70 percent and will not fit into a standard holding frame installation. There is wide variety in the

construction and design of these filters. Many require unique frames which preclude the use of different filter brands. The initial selection of this type of filter 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.

C. Category III

2.04 High Efficiency Filters: The third general type of filters consist of high efficiency filters that have ASHRAE dust spot efficiency ratings greater than 80 percent. They are usually divided into two groups; "85" percent filters having ASHRAE dust spot efficiency rating of about 80 to 88 percent and "95" percent filters having ASHRAE dust spot efficiency ratings of 90 percent or higher. These types of filters are used for critical telephone equipment areas (#4 ESS, #1 ESS) or computer centers located in high dust areas, etc., where the higher cost of filtration is justified. These filters are available in "supported" designs that may have a rigid construction or have the media fitted over wire basket supporting frames. The "non-supported" designs are called "sock" or "bag" filters. In the case of the non-supported design, the media is held in position by the pressure of the air flowing through the filter. In installations using the high efficiency filters, prefilters should also be used. The low efficiency cartridge type may generally be used as prefilters, however in large buildings the low efficiency type roll filters should be considered. Prefilters extend the life of the more expensive high efficiency filters.

3. FILTER MAINTENANCE AND REPLACEMENT PROCEDURES

3.01 Form SW-6290, Log of Filter Replacement (Exhibit 1), should be posted near the equipment filter section. The information on the form should be filled in each time the filters are changed on the heating, ventilating or air conditioning system. This record should show the following:

(a) Building name and equipment type

(b) Filter (draft) gauge reading with new filters

(c) Date

(d) Number of filters changed

(e) Filter (draft) gauge reading of the replaced filter and operator's initial at the time of filter change

(f) Other remarks.

3.02 Form SW-6290 may be ordered from Western Electric Company.

3.03 Recommended replacement times for KS-7406 filters are shown in Section 770-220-301, paragraph 4.03. Medium efficiency and high efficiency filters should be changed when the pressure drop across them increases by 0.5 inches of water at the same air flow conditions as were present when they were installed.

3.04 On systems using prefilters, a separate monometer and nameplate must be installed for each bank, and pressure drop across the prefilters should be replaced several times during the life of high efficiency after filters.

3.05 Proper filter installation and maintenance are very important. Filter which air can bypass the system. Care must be taken to seal edges and gaps between filters and holding frames. Openings and gaps between the edges should be sealed with a tape or a strip if the filter frame does not have a sealing strip of its own. If air bypasses the filters, the cooling/heating coils will become dirty very quickly. A dirty coil will cause a large loss of cooling/heating capacity.

3.06 Before changing one brand or kind of filter with another, a study should to conducted by the building design engineer. Cases have been observed where the filters installed were not suitable for the application. Either the filters were inefficient with very little pressure drop (causing the fan CFM to increase) or the filters had excessive pressure drop causing a reduction in air volume (CFM) and/or increase in fan horsepower. If a change is made from the type of filters initially installed, the performance of the system must be verified to insure that the system will function properly with proper air flow.

4. FILTER SYSTEM SELECTIONS

4.01 The filter efficiency required depends on the location of the building, the type of the telephone equipment and the overall economics of the system during operation. Switching systems such as step-by-step or panel have sliding base metal contacts, which are more tolerant to dust and contamination than equipment having precious metal contacts with little or no sliding action, such as cross-bar equipment. Newer electronic switching systems (ESS) and data tape machines are the most sensitive to fine dust.

4.02 Table A (Exhibit 2) gives general guide lines for the air filters required for different types of telephone buildings in locations indicated by the environmental characteristics in Table B (Exhibit 3).

4.03 Usually a separate filter is not required for fresh air intake, if adequate filtration is provided in the main air handling unit's mixed air chamber. However, if air is introduced directly into the room, (without passing through the fan filter section) or in extremely pollutant urban areas, filters may be required at the outdoor air intake dampers.

4.04 Filters shall not be installed on the exhaust openings (grill or dampers). Filters at the exhaust openings will add unnecessary cost, create unnecessary resistance to the air flow, and unload accumulated dirt into the room when reverse flow occurs.

5. PROCUREMENT AND SPECIFICATION OF FILTERS

5.01 Experience has shown that it is very difficult to provide a specification for filters that will take into account all factors involved without expensive testing. It would be almost impossible to write a single specification that would cover all types of filters described in this practice. It is recommended that the filters defined by the characteristics given herein be obtained on a competitive basis as general trade items. ASHRAE Air Filter Test Standards 52-76 (a certified copy should be obtained from the filter manufacturer) shall be used to compare any brand filters to meet the requirements in each Category listed in this practice.

5.02 All filters shall conform to the following general requirements.

(a) U.L. Listing: All filters intended for use shall be U.L. (Underwriters Laboratories) listed meeting the requirements of U.L.-900-Class II.

(b) Construction: The filter medium shall be uniform across the surface without thin spots or holes through which partially filtered air could flow. There shall be no gaps where the medium joins the frame.

(c) Adhesive: If used, adhesives shall not be corrosive, release vapors that are health hazards, cause contamination of electrical contacts, or have objectionable odors.

(d) Efficiency Ratings: A filter's efficiency rating shall be its arrestance (weight percentage of a test dust removed) or atmospheric dust spot efficiency, certified by an independent laboratory test as meeting the requirements in accordance with the American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Tests 52 through 76.

(e) Workmanship: Workmanship shall be of high quality. Filters must have consistent dimensions from one production lot to another.

(f) Air Flow Direction: Air flow through the filter shall be indicated by an arrow, color of the media, or by some other means on the filter.

(g) Labeling: The manufacturer's name, size, and rating shall be indicated on filter and packaging.

5.03 Category I - Primary Filters shall meet the following requirements.

Conventional glass fiber and similar disposable primary filters are covered by and are obtainable under specification KS-7406. Bell Laboratories study in 1973 indicates that filters of Category I (including KS-7406) under certain conditions, may release glass fibers into building air supply. This may be detrimental to our telephone equipment contacts. Also short fibers (7 microns or less) could be inhaled and cause upper respiratory irritation. If air velocity through the filter is very high or if the filters are mounted too near or on top of the blower, the chances of the fiber release will be increased. Therefore these types of filters should be used on a limited basis. Also, the fiberglass filters have a tendency to unload dirt back into the air stream after a certain pressure drop is reached and then the pressure drop goes down. The KS-7406 and other fiberglass filters should be changed periodically as mentioned in Section 770-220-301 and not on a basis of the maximum pressure drop. (Due to repeated loading and unloading of these filters maximum pressure drop may not even occur.)

5.04 Category II - Medium Efficiency Filters shall conform to the following requirements. These type filters are used in the majority of our buildings.

(a) Efficiency: This filter shall be certified as having a minimum ASHRAE dust spot efficiency rating of 23 percent at a face velocity of 360 fpm.

(b) Pressure Drop: The initial pressure drop across the clean filter at a face velocity of 360 fpm shall be less than 0.25 inches of water.

(c) Category II medium filter should meet the same general requirements listed in paragraph 5.02.

5.05 Category III - High Efficiency Filters shall conform to the following requirements.

NON-SUPPORT TYPE

(a) Efficiency: The efficiency of this filter shall be certified as having a minimum ASHRAE atmospheric dust spot rating of 80 percent for an "85" percent filter and 90 percent for a "95" percent filter.

(b) Pressure Drop: The initial pressure drop across a clean filter at a face velocity of 500 fpm shall not be more than 0.4 inches of water for an "85" percent filter and 0.55 inches of water for a "95" percent filter.

(c) Media: The Filter shall have a sufficient media area so that media air velocity does not exceed 25 fpm at maximum rated capacity.

(d) Construction: The filter shall have a one inch thick frame of metal or a similar strong material. The pockets or "socks" shall be provided with loops at their back ends or with some other means of support that will keep the media from fluttering or sagging should the flow rate decrease.

SUPPORT TYPE

(a) Efficiency: The efficiency of this filter shall be certified as having minimum ASHRAE dust spot rating of 80 percent for an "85" percent filter and 90 percent for a "95" percent filter.

(b) Pressure Drop: The initial pressure drop across a clean filter at a face velocity of 500 fpm shall not be more than 0.75 inches of water for a "95" percent filter.

(c) Media: The filter shall have a sufficient media area so that the media air velocity does not exceed 50 fpm at maximum rated capacity.

(d) Construction: The filter shall have a pleated configuration. The filter shall be constructed so that it will always fit its supporting frame without stretching or tearing. The holding frame installation shall have no paths for air bypass.

6. REFERENCES

1. AIR FILTRATION - Section 760-230-110, January 1978

2. ASHRAE - 1976 - Fundamentals - by American Society for Heating, Refrigerating and Air Conditioning Engineers

3. ASHRAE - 1979 - Equipment - by American Society for Heating, Refrigerating and Air Conditioning Engineers

4. ASHRAE - 1980 - Systems - by American Society for Heating, Refrigerating and Air Conditioning Engineers

5. Bell Laboratory Specification for Filters - X-74417, Issue 1, January 31, 1978.

6. Bell Laboratory Report No. 55738, issue January 24, 1973.

7. Federal Construction Council - Technical Report No. 34 - by National Academy of Sciences - National Research Council, Washington D.C. date 1959.

8. Filter Data - by American Air Filter Company

9. Filter Data - by FARR Filter Company

10. Method of Testing Air-Cleaning Devices by - ASHRAE, Tests 52-76

EXHIBIT 1

FORM SW-6290

Southwestern Bell

SW-6290
(Rev.6/81)

SECTION 770-220-900SW

LOG OF FILTER REPLACEMENT

DRAFT GAUGE
READING WITH NEW FILTERS

BUILDING _____ _____

CITY _____ EQUIPMENT NO. _____

DATE	READING	NO. FILTERS REPLACED	OPERATORS INITIALS	DATE	READING	NO. FILTERS REPLACED	OPERATORS INITIALS

REMARKS:

NOTE: FILTER REPLACEMENT.
(1) For KS7406 filter see BSP 770-220-900, Paragraph 4.03.
(2) For medium & high efficiency filters replace when pressure gauge reading increases by 0.5 inches from the original reading of a new filter.

EXHIBIT 2

TABLE A

770-220-900SW

TABLE A

RECOMMENDED TYPES OF AIR FILTER SYSTEMS

OFFICE	ENVIRONMENTAL CATEGORIES*			
	A	B	C	D
#1 ESS & Computer Centers with Low Personnel Activity	II	II	II or III (85)	II or III (85)
Large Toll (#4ESS, #1ESS) & Computer Centers with High Personnel Activity	II	II	III (85)	** III (85 or 95)
#2ESS & #3ESS	II	II	II	II
Crossbar, CDO and Step Offices	II	II	II or III (85)	II or III (85 or 95)
Offices	I or II	II	II	II
Data Tape Machines	III (85)	III (95)	III (95)	III (95)

* See Table B (Exhibit 3)

** Figures in parentheses are the "dust spots" efficiency drops.

NOTE: When type III filters are used, a prefilter of category I should be used to prolong the life of type III filters.

EXHIBIT 3

TABLE B

SECTION 770-220-900SW

TABLE B

LOCATION ENVIRONMENT CATEGORIES

CATEGORY	TYPICAL ENVIRONMENT
A	Rural and Semirural areas with normally slight to moderate amounts of airborne dust and aerosols. (See Notes 1 & 2.)
B	Small towns and small cities with moderate to somewhat heavier amounts of airborne dusts and aerosols. (See Notes 1 & 2.)
C	Large cities and industrial locations with a high frequency of smoke or smog occurences, having considerable amounts of smokes and dusts having medium (5-10μ) and larger (>10μ) sized airborne particles. (See Note 1.)
D	Large cities and industrial locations with a high frequency of smoke or smog occurences, having large amounts of corrosive smokes and dusts having very fine (>1μ) sized airborne particles. (See Notes 1 & 3.)

Note 1: If there is heavy motor vehicle traffic in the neighborhood of a location, its category should be moved to the next higher type.

Note 2: Regions in the western U.S. with considerable wind blown dust should be moved to the next higher type.

Note 3: In some special cases where corrosive gases or sulfur vapors cause equipment problems, special filters such as carbon filters may be needed. In such cases Bell Laboratories should be consulted.