SECTION ~~H34.204~~
SECTION H51.353
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AT&TCo Standard

VENTILATION

BASEMENT SPACES

1. GENERAL

1.01 This practice covers procedures suggested for the ventilation of power rooms, engine rooms, transformer vaults, cable vaults, boiler rooms, coal storage vaults, oil tank enclosures and gas meter compartments located in basements of telephone buildings.

1.02 The section is reissued to include additional recommendations pertaining to explosion protection and to provide reference to other Bell System Practices relative to the general subject. For operation and maintenance application, the section is dually numbered with this issue and the same issue number is assigned for uniformity.

1.03 The procedures are intended to apply primarily to future buildings, but may be considered, where advisable, for improving existing conditions.

1.04 In order to avoid the possibility of transmitting noxious or explosive gases from the basement to other parts of the building, it is desirable that no portion of the basement space be connected to the recirculatory system of any ventilating plant serving stories above the basement. As an additional precaution, it is advisable wherever practicable, to seal off cable ducts, pipe shafts and similar openings in the basement area to reduce the possibility of explosive pressures penetrating to upper stories.

1.05 The recommended standards for the construction of fire-resistive basement walls and partitions are outlined in B.S.P. Section H41.230, Interior Construction to Restrict Spread of Fire.

1.06 The recommendations pertaining to transformer vault design and explosion venting are based in general, upon the National Fire Codes; Volume V, National Electrical Code, and Volume II, The Prevention of Dust Explosions (Appendix B).

1.07 Where these suggested procedures are exceeded by local or State codes the legislated requirements are followed.

2. TRANSFORMER VAULTS

2.01 The requirements for vaults and their design based upon the type and capacity of the transformers, are outlined in National Fire Codes, Volume V - National Electrical Code, of the National Fire Protection Association. In telephone buildings the vault enclosure of transformers is generally considered advisable for the protection of building personnel and to prevent damage to the building or contents in the event of fire, escape of harmful gases or possible transformer explosion.

Location

2.02 Transformer vaults are generally located where they can be ventilated to the outside air without the use of flues or ducts. Where adjoining lot space or public space is available and may be used for this purpose, transformer installations outside the building have the advantages of being more readily vented for heat or gas dissipation and the release of pressures resulting from possible transformer explosion. Basement installations are preferably located adjacent to an exterior wall with vents opening directly into an areaway, or if above grade, to the outside.

2.03 General fire-protective recommendations for consideration in connection with transformer installations within telephone buildings are outlined in B.S.P. Section H41.230, Interior Construction to Restrict Spread of Fire.

Heat and Gas Dissipation

2.04 For the dissipation of heat, vaults are provided with adequate ventilation to prevent transformer temperatures in excess of the values prescribed in American Standards for Transformers, Publication C57.1 of the American Standards Association. Vaults ventilated to outdoor air without the use of ducts or flues, have a combined net area of all ventilating openings of not less than 3 square inches for each KVA of transformer capacity in service, except that the net area is not less than 1 square foot for any capacity under 50 KVA. In the event it is necessary to use ducts or flues for dissipation of heat, the ventilation area is determined as above, with consideration

of the adequacy of the air supply and draft effect of the duct or flue. The duct or flue construction is recommended to conform to the requirements for cable vault vents outlined in Paragraph 3.03.

2.05 Vaults ventilated by natural circulation of air may have roughly half of the total area of required openings in one or more openings near the floor and the remainder in one or more openings in the roof or upper exterior wall; or all of the area of required openings may be provided in one or more openings in or near the roof. It is desirable that no openings for ventilation be constructed through an interior wall common to the vault and the building.

2.06 Ventilation openings are located as remote as practicable from doors, windows, fire escapes and combustible material. Openings are covered with durable gratings, screens or louvers, according to the treatment required to avoid unsafe conditions.

2.07 If automatic dampers are used in the ventilation openings in exterior walls of vaults containing oil-insulated transformers, the actuating device should function at a temperature resulting from fire and not at a temperature which might prevail as a result of an overheated transformer or bank of transformers. It is important that the unintentional closing of the automatic damper be avoided.

2.08 Incombustible insulating liquids used in some transformers, when decomposed by the electric arc in a transformer failure, evolve non-explosive gases which, however, if not released, can build up sufficient pressures to burst the tank, as oil can do, releasing liquid and gas in large amounts and for considerable distances. Ducts or flues for ventilation may serve to distribute the highly objectionable gases if extended through other building areas and it is desirable that direct outside ventilation be provided wherever practicable. Transformers rated in excess of 25 KVA and using non-flammable insulating liquid are furnished with a pressure relief vent and provision is made for absorbing the gases generated by arcing inside the case by a connection to a chimney or flue especially constructed for the purpose or, preferably, openings or vents from the transformer enclosure directly to outside air.

Explosion Relief Venting

2.09 The procedures for explosion relief venting outlined in the following paragraphs, where provided, eliminate the requirements for heat and gas dissipation described in the preceding paragraphs. It is important, however, where explosion relief venting is provided that any ducts or flues formerly used for heat and gas venting, are closed off at the vault wall or roof with construction equivalent to the walls enclosing the vault.

2.10 Vault construction to withstand explosion pressures includes the provision of suitable openings or vents to release explosive gases, and to direct the force of the explosion in a manner which will afford maximum safety to personnel, with a minimum hazard to telephone equipment and the building structure.

2.11 The size of the openings or vents required to release explosion pressures safely is influenced by the expected intensity of an explosion, the shape and strength of the vault, and the location and type of vent used. In the absence of data on the ratio of free open area to vault room volume which will satisfactorily vent transformer vaults of all types, it is suggested that openings of vents be provided on the basis of known ratios for mild to moderate explosion hazards.

2.12 Where adequate venting area may be provided it is recommended that the net area of openings or vents be in the order of 1 square foot for each 80 cubic feet of vault content. Openings or vents of this ratio can be expected to prevent the building up of explosion pressures in excess of 300 pounds per square foot on the walls and roof of a cubicle shaped enclosure, in the explosion of gases of mild to moderate force intensity.

2.13 The walls and roof of transformer vaults are preferably of 6-inch reinforced concrete securely anchored together and to the floor. Where masonry walls are used, they are recommended to be of solid brick, reinforced and securely joined to the floor and roof of the vault. In the event of higher ratios of net area of openings or vents, consideration is given to vault construction to withstand higher explosion pressure. It is suggested that a reasonable factor of safety be included in the design of transformer vaults.

2.14 Wall openings for venting directly to outside air are generally equipped with louvers. Additional venting may be provided, if necessary, by the installation of the louvers and outside entrance door with light construction and wall anchorages which will release in the low pressure limits of an explosion. The use of ventilated sash hinged to swing outward under predetermined pressure from within; fixed sash or perhaps wood louvered

panels with light wall anchorages; scored glass or light wall panels are also considered where acceptable. However, with the use of vent closures which will be blown out in an explosion, it is important that protection against flying material be provided.

2.15 In the event it is necessary to extend explosion vent ducts within the building all portions of the ducts are constructed, preferably of reinforced concrete or steel shell, to conform to the requirements for the vault walls and roof.

3. CABLE VAULTS

3.01 The following measures are intended as a reference in providing adequate ventilation and incidental protection against explosion hazards in cable vaults or fire in the general basement.

3.02 Recommended procedures for the design and construction of cable vaults are outlined in B.S.P. Section AG40.60, Conduit Underground Entrances to Central Office Buildings and B.S.P. Section H41.230, Interior Construction to Restrict Spread of Fire.

3.03 Ventilation: Vent flues 8 inches to 12 inches in diameter or rectangular flues of equal capacity extending from the vault ceiling to the roof are recommended for each cable vault. The flues are usually spaced - one at each end of the vault and intermediately at every other wall column, the larger flues being used for the wider vaults. It is desirable that joints in the flue linings be made as tight as practicable. Flues constructed with rigid, impervious and non-corrosive duct such as compressed asbestos-cement pipe have the advantage of specially formed pressure-tight joints. In order to guard against possible leakage of gas between the cable vault and the story above, it is desirable that each initial length of flue lining at the vault ceiling be placed in position prior to pouring the surrounding structural floor slab. In certain instances, cable vaults are ventilated by means of openings through the exterior wall. In such cases these openings are equipped with louvers and wire mesh screen to prevent the intrusion of foreign objects into the vault and are protected by a fire damper constructed of 1/4 inch steel plate held open by a fusible link. It is desirable that these openings face on an unexposed side yard located on company-owned property. It is recommended that the location of such openings on street fronts be avoided.

3.04 Explosion Protection: The following measures are suggested for consideration in guarding against penetration, accumulation and ignition of explosive or flammable gas in cable vaults and in house cable ducts. The transmission of such gas to and from the vault may be minimized by the following provisions:

(1) Plug airtight all underground and house cable ducts, both cabled and empty, where they terminate in the vault. In this connection it may be desirable to design the vault termination of house cable ducts so as to facilitate plugging; also, to set each initial duct unit in place prior to pouring the surrounding structural floor slab to assure integral tightness.

(2) Construct solidly the partitions separating cable vault from basement, making them tight at floor, ceiling and adjacent walls. Other than the entrance doorway, provide no openings between the cable vault and other basement space. Promptly and tightly cement up or otherwise permanently seal all shrinkage, settlement or other cracks that occur at any time in or between walls, partitions, floor slabs, etc.

(3) Place no gas piping in cable vaults or within the construction enclosing them. Arrange cable vault drains, where possible, to discharge into a sump-pit. Direct connection of the vault drain to the sewerage system is undesirable since the drain trap water seal is subject to evaporation.

(4) Avoid locating electric switches inside the cable vault. Switches controlling cable vault electric lights are mounted on the basement side of vault partition adjacent to the entrance door. Equip electrical outlets for soldering pot connection within the vault with special "receptacles with plugs" approved by the Underwriters' Laboratories, Inc., for use in hazardous locations. Explosion-proof lighting is not generally required in cable vaults.

(5) It is recommended that any detected odor of gas be immediately reported, investigated and the leak corrected. Gas may seep through ground into the vault from gas mains in the streets or alley.

4. HEATER ROOMS

4.01 Heater rooms are generally considered hazardous locations and it is important that they be adequately cut off from other basement areas. The boiler room enclosure is

also considered desirable because of the adverse draft effect of the building shaftways and of central ventilating equipment or emergency power equipment operating in adjacent areas. For these reasons, it is recommended that the boiler room door be maintained in the closed position and that a separate boiler room air supply be provided from outdoors.

4.02 The provision of an opening adequate in size and properly located between the heater room and outside air generally affords both satisfactory ventilation for the room and ample air supply for heater combustion. It is desirable that the opening be louvered, screened and of such size that its net open area will approximate that of the associated chimney flue. The opening is usually provided by louvering a portion of heater room window or by piercing an adjacent outside wall. Where neither of these methods is practicable, a metal intake duct is installed to connect a remote exterior opening with the heater room. It is customary, of course, to equip such ducts with self-closing fire dampers where they pierce fire walls or fire partitions, also at the outside opening if these are an external fire hazard. Most effective room ventilation is usually obtained by locating the air intake opening as remote as practicable from the heater and breeching air damper.

5. POWER ROOMS

5.01 Where basement power rooms can not be furnished with window openings sufficient to afford adequate natural ventilation, the provision of induced ventilation is suggested. Power exhaust units are, as a rule, sufficient for normal size rooms; large rooms, however, may require powered units in both intakes and exhausts. The ventilation openings are usually furnished with louvers and screens, and if accessible from outside they are equipped with bar guards. Filters are usually provided only in intake openings. Locating the room exhaust openings as remote as possible from the intakes is effective in obtaining maximum air circulation, and in certain instances may require the provision of metal ducts. The number of air changes per hour will, of course, depend upon the relative amount of heat producing equipment in the room.

6. INTERNAL COMBUSTION ENGINE ROOMS

6.01 It is expected that the recommendations contained in Bell System Practice Section AA360.015 entitled, "Ventilating Equipment for Rooms Having Engine Driven Generators - Power Systems" will be followed in providing for dissipation of heat during periods of engine operation. Although the enclosure of diesel engine alternator sets is not normally required, it is recommended that the installation be made with consideration of possible enclosure later if necessary, and arrangement made for future supply of ventilation and combustion air. Where internal combustion engines are located in open basement spaces in the vicinity of boiler rooms, it is suggested that appropriate measures, such as keeping the boiler room door normally closed, be taken to prevent the action of powered exhaust units from adversely affecting the boiler drafts. Air intake openings to engine spaces are amply screened and louvered to prevent the induction of dirt and rain.

6.02 In order to avoid the accumulation of explosive vapors in rooms enclosing gasoline engine driven generators, two vent openings to the outer air are usually provided, each being about 100 square inches in area. These supply and exhaust openings are located generally near the ceiling and remote from each other - the exhaust being equipped with a sheet metal duct arranged to terminate about 6 inches above the floor. Gasoline engine rooms having one or more windows may be readily provided with vent openings by substituting louvered metal panels for upper lights of glass.

6.03 Where the foregoing procedures conflict with or are exceeded by corresponding provisions of local or state legislation, the legislated provisions should, of course, apply.

7. COAL STORAGE VAULTS

7.01 In order to avoid the possibility of spontaneous ignition in stored coal, particularly bituminous coal, it is necessary to exclude, as far as practicable, air, heat and moisture from the storage space. This is on the basis that oxygen is required to originate and maintain combustion, also that its action is aggravated by the presence of heat and moisture. Coal which has been oil treated to reduce dust in handling is particularly subject to spontaneous ignition and storage in large quantities is not recommended.

7.02 Ventilation for coal vaults is therefore undesirable, and it is suggested that all practicable measures be taken to make the vaults reasonably tight against penetration or introduction of air, moisture and heat. Coal chute covers are usually sealed with appropriate gaskets; cracks, sleeves, etc., in surrounding walls are cemented up and entrances made reasonably airtight. Leaks in water and

steam pipes, valves and connections within the vault are corrected, and pipes carrying cold water are insulated to preclude condensation. Steam or hot water lines located where they are subject to being covered with coal are protected, for example, with a covering of concrete.

7.03 Suggested procedures for the installation of heating equipment and additional information related to this practice are outlined in B.S.P. Section H42.110, Heating Equipment - Fire Protection.

8. GAS METER COMPARTMENTS

8.01 From the standpoint of minimizing damage to meters and the hazard of escaping gas entering the building due to leaky connections at meters and shutoff valves, it is desirable that gas meters be located in separate compartments or vaults ventilated directly to the outside air. It may be desirable also to place water meters in the same compartment from the standpoint of having all meters at one location.

8.02 Gas meters should be adequately supported and connected to piping in such a manner as not to exert undue strain on the connections.