

VENTILATION AT FIRES

One of the greatest menaces to the firefighter is the large volume of smoke which can be produced in a short space of time in a building on fire.

The volume of smoke that prevents a firefighter from rapidly attacking the fire is not always an indication of the extent and severity of the fire. There are several reasons for venting a fire: **to prevent the heat in a building becoming bottled up and thus leading to the further spread of fire; to obviate damage by heat and smoke to commodities, furnishing etc.; to enable firemen to enter the building and to extinguish the fire without having to endure excessive smoke and heat punishment.**

Correct ventilation is the art of inducing heat and smoke to leave the building as quickly as possible by such paths that a minimum of damage will be caused. Carried out correctly, ventilation will have a considerable effect in reducing fire and smoke damage; carried out incorrectly, it may easily result in a fire spreading and getting out of control. A sound knowledge of how buildings are constructed is essential in order to know at what point in the many different types of building, ventilation can be most easily and effectively carried out. The proper course to follow varies with circumstances and it is only by experience that an officer can decide on the appropriate line of action.

I. BEHAVIOUR OF SMOKE

What is called smoke at a fire is generally a mixture of smoke (usually fine solid particles) fog (liquid droplets of combustible distillates together with droplets of the products of combustion usually water) and substances which may be released from the materials involved in the fire.

At fires, air is often heated to over 500° C (930° F) and, because any given quantity of a hot gas is lighter than an equal quantity of the same gas at a lower temperature, it will tend to rise very rapidly and with great force, carrying the smoke with it. This is shown by the way in which burning embers are often carried through the air to considerable heights, and is one of the reasons why solid jets of water of large diameter are required at serious fires to do effective work. If a spray or broken jet is used, the velocity of the rising gases is often sufficient to keep the water from reaching the seat of the fire.

2. REASONS FOR VENTILATING AT FIRES

a. Danger and Difficulty to Firemen

One of the main reasons for ventilation is to enable the firemen to carry out his work more easily, to permit the rapid location of the seat of the fire and to reduce the possibility of excessive water damage through using a jet prematurely.

b. Suffocation of Occupants

Another reason for early ventilation is that most fatalities from fire are due to suffocation rather than actual burns and even where there is burning, the victims are usually dead from super-heated gases and smoke before the flame touches them. Ventilation should be started as quickly as possible, particularly where lives are at stake.

c. Fire Spread Through Mushrooming

Heated gases will rise up any available pathway and if there is no vent or release at the top of the building, they will tend to spread out across the ceiling at each floor level of the building which confines them, carrying any flame which may be present. This is known as '*mushrooming*'. It is one of the most frequent causes of the spread of fire through roof spaces or from floor to floor. Another reason for ventilation is to prevent mushrooming and to check the spread of fire.

d. Damage to Contents

By early ventilation, much can be accomplished in the reduction of damage due to smoke and in the prevention of the formation and accumulation of flammable gases.

3. WHEN TO VENTILATE

It is not always easy to determine the right time to ventilate. Ventilation should not be started until branches are in position and ready to prevent the spread of fire due to the admission of air.

4. HOW TO VENTILATE

There are two general methods of ventilating buildings on fire:

- i. vertical, or top, ventilation
- ii. lateral, or slide ventilation

The venting of a burning building follows one or other of these methods; in some cases both patterns may be used.

a. Vertical or Top Ventilation

For most multi-storied buildings, ventilation carried out by fire brigade personnel should as far as possible, start with the **highest point in the building** which it is possible to reach.

If venting is to be effective, **it is necessary for cold air to flow into a building to replace the hot air and gases flowing out through the top or roof of veins and adequate inlets for cold air are therefore required**

Where the nature and density of the smoke or the possible presence of dangerous fumes justifies it, men wearing breathing apparatus should be employed to ventilate smoke-logged staircases and rooms

b. Lateral or Slide Ventilation

The physical properties of a building and contents on fire may be such that top ventilation is not practicable. Alternatively, the location extent of the fire or accessibility of points of ventilation, windows, fire escape or other possible openings, may make vertical ventilation impracticable.

For the individual room in a private house the natural form of ventilation is generally the open window. Windows of the sash type should be opened at the top and bottom, two-thirds of the way down from the top and one-third up from the bottom. The top opening allows the hot expanded gases to escape and the bottom opening admits fresh air.

The weather plays an important part in ventilation, especially in lateral ventilation. There is a greater danger of spreading fire through incorrect venting by means of windows and other openings than when vertical shafts are employed to draw off smoke and heat.

Generally no lateral or cross-ventilation should be undertaken without due consideration of (i) the direction and force of the wind; (ii) the determination of

which side of the involved buildings is the **leeward** and which is the **windward**;
(iii) the humidity and temperature factors.

c. Methods of Venting Buildings

It is important that when men are fighting their way up a staircase, jets from outside should not be got to work through any open windows in the building. This would not only stop the heat and smoke venting itself to open, but would drive it further into the building.

Cutting a hole in a roof to form a vent should only be resorted to when other equally good or better methods are not possible.

When making an opening in a roof, a position should be taken on the **windward** side so that any sudden rush of smoke and hot gases is carried away from the fireman.

Adequate ventilation is that which does the job – that which removes smoke and gases so that the fire may be reached and extinguished with the minimum of damage to building and contents by the fire and its products of combustion.

d. Smoke Extractors

Another method of ventilation is by the use of smoke extractors. When using smoke extractors, it is important to ensure that accelerating the movement of air does not intensify the fire or cause it to spread.

5. VENTILATION OF LARGE SINGLE-STOREY BUILDINGS

Many of the largest factories are of single-storey construction, comprising extensive production areas covered by a light roof structure and without interior walls other than those separating off subsidiary workshops and storerooms. Buildings of this type present special problems from a fire point of view; the absence of interior division walls, the use of unprotected roof trussing and of unsuitable materials in roof construction are among the contributory factors. In addition, many single-storey factories contain processes or materials of high hazards, so that such buildings are prone to rapid fire spread.

Rapid fire spread in undivided buildings occurs because of three commonly found features, viz., the absence of any barriers to the spread of fire and smoke,

the presence of large air supplies and the absence of any quick means of releasing the heat produced.

6. USE OF JETS

Where an aperture has been made in a roof solely for the purpose of ventilation, it would be manifestly unwise to play water into that hole, as the object of opening up is to induce a draught that will carry away the smoke and hot gases. If a jet is directed into the aperture it will tend to drive the gases inwards

7. PRACTICAL APPLICATION

Basement Fires

In the case of basement fires, it is advisable to open up all doors and windows front and rear of the ground floor, so that firemen may enter this floor and cover any shafts leading up from the basement. To be effective, cold air entering a basement should be introduced as near to the floor as possible, otherwise it will mix with the hot smoke and gases in their upward path, entraining them and pulling them down. It is generally advisable, therefore, when ventilating a basement to have two or more openings as widely spaced as possible, preferably on opposite sides of the buildings.

CONTROL AT A FIRE

I. OFFICERSHIP

The officer in charge of a fire must never overlook the fact that upon his bearing will depend that of the crews working under him. He should at all times appear imperturbable and any **orders which he gives should be given clearly and simply, without shouting or sign of excitement.**

The duty of the officer in charge at a fire is to **size up the situation as a whole and to issue the necessary orders.** Self-confidence, experience and the ability to make quick decisions are therefore essential. An officer should never send men into a position in which he would not go himself and, in fact, when it is necessary to station men in an obviously dangerous position, a good officer should go with them and remain with them until he is confident that it is safe for them to be stationed there.

Every care must be taken by officers of all ranks to ensure the safety of the men engaged in fire-fighting operations under their particular command.

A point which is often overlooked is that all officers on the fire ground should be correctly dressed in the kit and should insist that all crews are dressed likewise. Men cannot be expected to keep neat and tidy when fighting fire, but slovenliness should never be countenanced at any time; it will tend to bring the Fire Service into disrepute at a time when not only the eyes of the public are focused on the Fire Services, but often television and film camera in addition.

2. OFFICER IN CHARGE OF THE FIRST APPLIANCE

a. Before The Fire

The better the knowledge an officer has of the ground covered by his station, the better he will be able to deal with fires occurring on it

b. On Arrival

At most fires the fire brigade officer will be confronted on arrival with a number of matters which will required his immediate attention. These will include:

- (i) making an appreciation of the situation and deciding whether the appliance and equipment he has or will shortly have are sufficient to control the fire;

- (ii) effecting any necessary rescues and searching the building;
- (iii) finding the fire, and tackling it with the appropriate extinguishing medium
- (iv) surrounding the fire and preventing it spreading. He will also have to consider the need for ventilating the fire and for carrying out any necessary salvage operations.

3. OFFICER IN CHARGE OF FIRST ATTENDANCE

a. Estimating Assistance

Making an estimate of what additional help is required calls for rapid assistance of the position – generally known as the ‘sizing up’. This sizing up must take into account the following principal factors:

- i. How far the fire is likely to spread before a suitable stop can be effected.
- ii. How many and what type of jets are likely to be required to subdue the outbreak and consequently the number of pumps required to feed them.
- iii. Whether any special appliances are required, eg. escapes or turntable ladders for rescue purposes or to gain access to high windows.
- iv. The nature of the exposure surrounding the building and whether the outbreak seems likely to threaten them.
- v. Whether or not the water supplies available are close at hand and will prove adequate, whether a water relay will be required.
- vi. The nature of the goods stored or manufactured in the premises and the influence the type of construction of the building will have on operations.
- vii. Whether the fire is on the top of a tall building, for this may well require a larger attendance than one at a lower level.

SALVAGE AT FIRES

i. Aims of Salvage Work

Fire salvage has one basic aim - the minimizing of losses consequent upon outbreaks of fire and the effects of fire fighting operations.

ii. Phases of Salvage Work

Salvage work at fires can be divided into three phases, although lines of demarcation are not always clear.

Phase 1 includes work which takes place simultaneously with firefighting and is intended to prevent avoidable damage. This is usually the most important; it is certainly the most urgent if serious damage is to be prevented.

Phase 2 follows the completion of Phase 1 and the operations here are aimed at mitigating the effect of damage which has occurred. This is generally accomplished by drying out premises and preventing deterioration.

Phase 3 is the prevention of subsequent damage or loss.

b. Messages

Messages should be originated only by, or with the authority of, the officer in charge of the fire and they should be sent by the quickest available means.

Messages have a twofold function, for they not only serve to ask for assistance, but also give senior officers at their headquarters some indication of the size and nature of the fire. Even if further assistance is not required, an '*informative*' message should be sent as early as practicable.