



Training and Equipment VOLUME 5

SALVAGE AND OVERHAUL

CHAPTER 6

09/03/85

OVERHAUL

SUBJECT 2

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I. INTRODUCTION

- A. Purpose: To provide Department personnel with the knowledge that will allow them to establish a safe, thorough, and orderly system of overhaul.
- B. Scope: This instruction applies to all personnel who may be required to perform overhaul operations.
- C. Author: The Deputy Fire Chief of the Administrative Bureau, through the Training Section, shall be responsible for the content, revision and annual review of this instruction.

II. RESPONSIBILITY

- A. All Personnel shall be responsible for having a basic understanding and working knowledge of the theories and techniques mentioned in the following instruction.
- B. Station Captains shall insure that their personnel follow these guidelines for a safe and thorough overhaul.

III. POLICY

- A. It shall be Department policy that a thorough overhaul be completed following each fire.

IV. APPENDIXES

- A. Appendix I - Overhaul, General Information



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APPENDIX I

OVERHAUL, GENERAL INFORMATION

Overhaul is the search for, and extinguishment of, hidden or remaining fire, placing the building, its contents, and fire area in a safe condition; determining the cause of the fire, and recognizing and preserving any evidence of arson. Frequently salvage and overhaul are carried out simultaneously, but they are two separate and distinct functions of the Fire Department.

In fire protection, there are two kinds of fires which the fire fighters may come in contact with - accidental fires and intentional fires. Regardless of the kind of fire, the fire fighters' primary objectives are to protect life, extinguish the fire and save property. The secondary objectives are:

1. To determine the cause of the fire
2. Recognize and preserve evidence
3. Search for hidden fires
4. Extinguish hidden fires
5. Make the building and contents safe
6. Make the area safe
7. Release the premises
8. Obtain data for official report

The purpose of the overhaul section of this article is to present techniques of operations that have been approved by the Fire Service Training Association and to develop procedures by which these conditions can be handled.

Fire departments have practiced overhaul operations to some degree since the first companies were organized, although such practices may not have been recognized as overhaul. The degree to which overhaul was performed came about as a natural desire of fire departments to do a good job.

As more and more fire departments assumed the responsibility of salvage operations, it became evident that placing the building in a safe condition was also a responsibility that could not be ignored. Because of its close relationship to salvage practices, overhaul was first considered as salvage overhaul and was made a part of salvage. Recent developments and added responsibilities of the fire department have brought about the request to recognize overhaul as a separate function due to premeditated fires.



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Value of Proper Overhaul

1. Helps locate hidden fires - proper overhaul involves a systematic handling of contents, merchandise, and debris to accomplish many purposes. One of these purposes is to locate hidden fires so that they may be extinguished and prevent further damage.
2. Helps prevent rekindle - proper overhaul does not in itself assure that a fire will not rekindle. Its practice, however, enables fire fighters to detect certain types of occupancies where rekindle is more likely to occur. Under these conditions, a fire fighter supplied with adequate extinguishing facilities should be detailed to watch the property.
3. Helps determine the cause - proper overhaul will ordinarily uncover the causes of the fire. The fire fighters ability to recognize the cause once it is exposed is another problem. A fire cause involves two conditions, the fuel supply, and heat source. A fire cause results when a heat source hazard and a fuel supply hazard are permitted to come together. When the cause of a fire is determined, both the fuel involved and the heat source which cause ignition should be reported.
4. Aids in recognizing and preserving evidence of arson - determining the cause of the fire goes hand-in-hand with recognizing and preserving evidence of arson. Among the items to look for in recognizing evidence are: Multiple fires, odors, undue wood charring and uneven burning, holes made in walls and floors; inoperative sprinklers and fire doors, tracks, fingerprints, condition of heating equipment, empty containers and residues of wax or paraffin. Proper overhaul will permit some evidence, which is to remain untouched and undisturbed, and will permit the safeguarding of other evidence that cannot be left at the scene of the fire.
5. Helps prevent unnecessary damage - successful overhaul does not necessarily need to follow a step-by-step procedure or pattern, but unnecessary damage to building and contents can be avoided if those who practice overhaul develop a routine system.
6. Permits removal of original fire cause - a routine system of overhaul not only helps determine the cause of the fire, but



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it pinpoints the location and permits its removal to prevent a recurrence. This can best be explained as follows: Suppose the cause was determined to be a gas leak which was ignited by a heat source; this affords the opportunity to remove the original cause by shutting off the gas supply.

7. Aids in placing the building in a safe condition - making the building safe can only be accomplished through a thorough knowledge of contents. Obviously, the facts concerning these conditions can best be gathered during a proper system of overhaul. Many unsafe conditions may be remedied during the overhaul process, but others must be handled even after other duties have been completed. The elimination of such unsafe conditions, such as hazardous processes, damaged utilities, structural defects, damaged contents, unstable objects, and open pits, always present a challenge to every fire department after emergencies.
8. Helps improve public relations - the value of salvage practices in public relations has been established. Likewise, overhaul practices are also contributing factors. Public relations is not a planned procedure by which personal gain is achieved, nor is it a "packaged service," obtainable for a price. The price that is paid by fire departments for good public relations is measured by their efforts to cooperate with property owners, law enforcement officers, utility companies, city officials and the public in general.

Some salvage practices may be performed in advance of fire extinguishment, as well as following the attack, but major overhaul must, of necessity, follow after the main body of the fire has been extinguished. The salvage that is done before and after the attack will have a direct bearing upon any overhaul that may come later, and many of the same tools and equipment generally consist of a normal complement of fire department equipment such as forcible entry tools, small hose lines, ropes, lights, and hand extinguishers. These tools, plus the various overhaul kits, comprise the majority of the overhaul equipment. Since overhaul follows the extinguishment attacks, such equipment and tools as may have been previously used during other operations will be on the fire ground.

Piles of debris should be worked over and smoldering particles extinguished. Partially burned articles should be worked over and separated from that which is to be removed from the building. Disposal of debris should be selected with care to avoid rehandling, blocking of access to areas which must be kept open, and the possibility of creating a fire hazard. Spraying of debris, as it is removed, reduces the possibility of rekindling.



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Wet particles should be placed in piles separated from those that are dry, and stocks such as furniture, which are wrapped or padded, must be unpacked and dried. When large amounts of materials are to be overhauled, or when overhauling operations are hazardous within the structure, it is necessary to remove materials to the exterior before overhauling. It is sometimes necessary to leave a fire fighter on the premises to watch for rekindling, and contact persons in charge of the establishment to provide ways and means of overhauling.

Overhaul is functionally related to fire extinguishment. Since overhaul procedures may not necessarily follow a pattern or plan, one of the first routine operations will probably be the searching for hidden fires. There are certain types of occupancies where complete extinguishment is extremely difficult and a continued search must be maintained over the area for a prolonged period.

CONCEALED SPACES

It is not the purpose of this article to describe methods of opening certain areas but rather to discuss these concealed spaces from the standpoint of where to search. Some of the more common spaces in the building are in walls and partitions, in attics and cocklofts, above ceilings and below floors, in basements, and in airshafts and ducts.

It is difficult to outline all of the operations that may be performed in searching for hidden fires and only the more fundamental conditions will be discussed. One of the first requisites before starting a search for hidden fires is to determine the conditions of the building in the area to be searched. The degree of intensity which the fire attained during burning and the amount of water used during its control are two important factors that influence the condition of the building. The first is the extent to which the structure has been weakened. The second is the additional weight on floors and walls because of the absorbent qualities of the stock. Consideration given to these two factors may prevent unnecessary loss of life during overhaul because of building collapse.



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An important objective in searching for hidden fires should be to make a systematic and careful check to determine whether the fire extended to other areas; then the problem is to determine which medium it traveled through. When floor beams have burned away at the ends where they enter a party wall, it is a good policy to overhaul the ends by flushing the voids in the wall. The far side of the wall should also be checked to see whether fire or water has come through.

During this operation, damage can be caused by ignoring the proper protection of surrounding contents of such buildings. Considerable salvage can be produced by careful overhauling after control of fires. When examining avenues by which fire might have extended, careful selection of openings must be made.

When the fire has burned around windows or doors there is a possibility that there is fire remaining within the casings. This requires removal of the facing to assure complete extinguishment. Another point of possible trouble is behind the cornices. When the fire has burned around a combustible roof or cornice, it is advisable to open the cornice and inspect for hidden fire.

When concealed space below floors and above ceilings or within walls and partitions are to be opened during the search for hidden fires, the furnishings in the room should be moved to a location where they will not be damaged. During these operations only enough wall, ceiling, or floor covering should be removed to assure complete extinguishment. Hidden fires in concealed spaces can often be detected by feeling with the hand by smelling, by discoloration, and by smoke. Insulation material in the form of battens often harbors hidden fires for a prolonged period and these battens must be dug out in order to locate the hidden fire.

Too much emphasis cannot be placed upon the importance of searching for hidden fires under debris and around merchandise. Because of the absorbent qualities of materials such as paper, wood, cotton and insulation that are likely to be in the piles of debris, it is considered to be the best policy to remove the material from the building whenever possible. Not only may such materials become a dangerous hazard because of the added weight and expansion, but it is frequently difficult to determine the exact location of the hidden fire within the pile. This is particularly true if the debris contains baled goods. Often, fallen structural members of the building form voids in which hidden fires smolder and later rekindle.



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During the removal of debris from buildings, careful observation should be made of any evidence of incendiaryism. If conditions arouse suspicion, the area involved should be left intact until further investigation has been carried out.

Making the building and area safe means the prevention of additional disastrous occurrences. The word SAFE applies to the protection of personnel and public against rekindle, explosions, falling objects, gases, chemicals, and open pits. To carry out this objective, the fire fighter must consider the building, its contents, and the area involved. The order in which they should be considered will depend upon the pertinence of the conditions.

This article deals with standards approved by the Fire Training Association. In doing research on overhaul and salvage, it is found that the proper application of water will reduce the amount of salvage and overhaul work for fire fighters. The first experiments were conducted by Chief Anders Firits, of Copenhagen Denmark, in 1931. The Iowa State University Fire Service Extension, Chief Instructor Floyd W. Nelson, and Keith Royer, Supervisor, produced the film "The Nozzleman." They also had a series of articles in Fire Engineering, September, November and December 1962. These articles deal with Thermal Balance and give important information regarding the use of water as an extinguishing agent. The time to plan overhauling and the amount of water to use is when preplanning inspections are being made, and during preplanning drills at the station.

The formula for the amount of water to use is:

$$\frac{\text{Cubic Feet Involved}}{100} = \text{GPM Flow}$$

The cubic feet of the building can be figured from preplanning inspections. With this knowledge, the fire fighter will have some idea as to the length of time that a given size nozzle, at the pressure recommended by the Department, will have to be opened to accomplish THERMAL BALANCE. If the fire fighter uses the right type nozzle stream, has been drilled in the preplanning of the building, and proper ventilation is used, overhauling and salvage will be easier.

Fire fighters working on a fire should strive for the ideal. If at the conclusion of blackout of the fire, the fire area is left with an even ceiling temperature of 300°F., conditions will be ideal for natural ventilation and easy, efficient overhaul.



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The lifting forces of the warm air (thermals) will be in balance throughout the area and we can say that we have left the area with the same thermal balance that was developed as the fire built up at a somewhat lower temperature. This will permit overhaul crews to move in rapidly as the fresh air enters the building at lower levels, and the remaining steam and smoke escape from upper levels. If, on the other hand, water distribution has been poor, we may have part of the area cooled to ambient temperatures of 500°F. to 1000°F. The upward thermal forces in the hot areas will push steam and smoke out and downward in the cool areas, and cause a circulation in the fire area which will limit visibility and hamper overhaul. The cool air will be heavily laden with carbon particles.

The greater the heat differential, the more violent this circulation will be. If cooling is continued on the perimeter, using a fog pattern too wide or a stream with insufficient reach, the problem is compounded and the heat in the hot spot will become more intense. This condition will keep the fire fighters from entering and may allow the fire to burn through to upper levels and get out of control. In a single-story structure, burning through the roof over the hot spot will relieve this situation.

When the area is quite large and several nozzle crews are involved and where there is more than one hot spot, the interaction between the various thermal forces pose additional problems for the fire fighter. If, on the other hand, rate of flow has been excessive or the right flow has been contained for too long a period, the entire fire area may be cooled to ambient temperature. In this case, as spot fires continue to give smoke, we find a heavy, muggy, smoke-laden atmosphere which is very difficult to remove efficiently with any amount of forced ventilation. Overhaul will have to be carried out with limited visibility, and gas masks will be an absolute necessity for entry.

A condition of thermal imbalance will be observed first by the fire fighter who has made the fire attack. If, for example, his pattern adjustment on attack has been too wide, immediately on shut down, he observes a downward movement of smoke and steam in the opening through which he has made his attack. This can often be corrected by making another short attack with a narrowed fog pattern for longer reach unless a partition or stock is blocking his application into the hotter area. If the fire fighter, at this point, understands the effect of thermal forces,



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observation of smoke and steam circulation will give him a good indication of where the hot spots are, even when they may be off to one side.

When a good thermal balance is established during blackout of the fire, then it is up to the fire fighter who ventilates and overhauls to maintain that balance, so that a rapid and complete overhaul can be carried out. Three main factors can operate to upset thermal balance and the orderly flow of clean air into a building during overhaul.

1. Doors or windows broken or opened on the windward side of a building with a strong wind blowing or forced ventilation used in the wrong place, can set up strong air currents that will hamper the orderly ventilation of the area being overhauled.
2. Spectators or fire fighters may block openings where streams of fresh air are flowing into the building.
3. Nozzleman are the ones most often guilty of upsetting the Thermal Balance and hampering their own efforts or efforts of other overhaul crews operating in the building. Using a fog pattern during overhaul on the ground floor, for example, may upset the air supply and visibility for overhaul crews on the second and third floors. During overhaul all nozzles should be operated with relatively short bursts and on a quite narrow straight stream pattern.
4. If master streams have been used to protect exposures or clear the way for attack at certain openings, these streams must be shut down or very carefully used during overhaul so that they do not hamper or, in some cases, actually prevent effective overhaul of the fire.

A heavy master stream used over a fire can, in some cases, so cool the products of combustion that they drop to the ground to flow back into the building and cut off visibility for the overhaul crews. A heavy stream operated from an aerial ladder downward through a roof opening may keep all overhaul crews out of a building. In some cases, blackout of a fire may leave some rooms in the structure still fully involved. On initial response, we may find that an interior room is fully involved and just beginning to push heat and products of combustion into the area through which the fire fighter must approach. In these cases, a



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good understanding of the principles of thermal balance can aid the nozzleman in extinguishing the fire quickly and with a minimum of punishment.

The reaction of some nozzleman, in these cases, is to use a relatively wide fog pattern on entering the building. This action will cool the overhead and cause steam and products of combustion to drop to the floor, thus cutting visibility and approach to the actual fire.

If, on the other hand, a nozzleman crawls along the floor, perhaps he can reach a doorway of the fire room where proper application to the main body of the fire can be made. In cases where both rooms are involved, the fire in one room must be knocked down to the overhaul point before a crawling approach is made to the second room.

OUT FOR SUCCESSFUL OVERHAUL

1. Plan - don't work against each other
2. Begin at top - don't scatter
3. Wet down or dunk material
4. Hazards:
 - a. Baled goods - watch for rekindle and water absorption
 - b. Drugs and chemicals
 - c. Dusts
 - d. Dwellings - valuables and leaving unoccupied

If properly preplanned, the whole operation can be done smoothly and efficiently.

GENERAL RULES

1. Be alert for arson
2. Check for evidence prior to entry; possible theft
3. Work in teams
4. Avoid further water damage
5. Keep unauthorized people out
6. Check utilities
7. Don't throw debris from windows-before checking area below

This article does not cover all parts of overhaul; it was not intended to. It shows how a fire fighter can save a lot of work and do a better job of fire fighting and save property.

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