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Training Bulletin #1

EXPLORING THE USE OF 1 INCH HOSE
IN STRUCTURAL FIRE FIGHTING

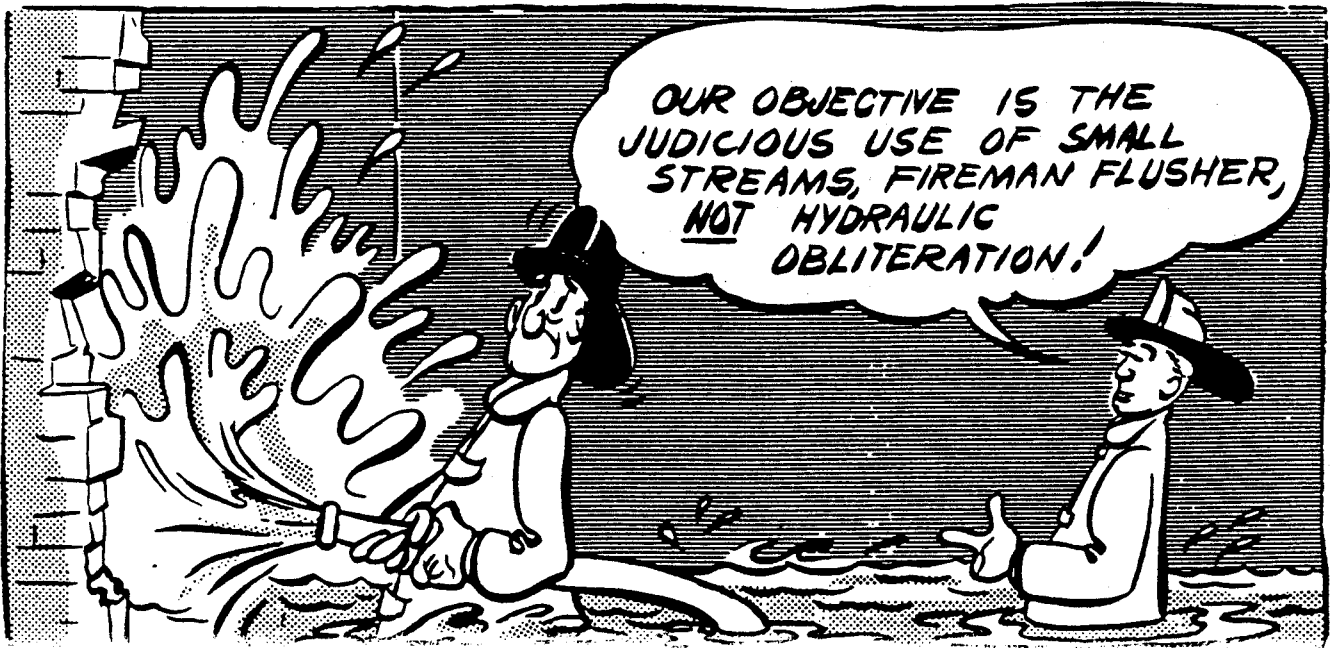
Introduction

Recently the Los Angeles Fire Department conducted a training program to explore the use and limitations of one-inch hose lines in structural fire fighting. This was done through the cooperation of the City Housing Authority in making available several condemned buildings in the Chavez Ravine area.

Thirteen High-Pressure Engine Companies, on both platoons, and the recent class of "rookies" participated in the program. Both Mack and Crown hose wagons were used. The experiments were restricted to the use of 1 inch hose lines except in those situations where limitations had definitely been reached.

Objectives

1. To explore the effectiveness of the "indirect" method of applying water on a fire, as opposed to the conventional method of applying water directly to the seat of the fire.---Note: The "indirect method" may be defined as: "the cooling of the area directly above the fire, in a confined space, using a fine spray or fog stream."



2. To determine the maximum effectiveness of 1 inch high pressure hose lines by going beyond their conventional limitations.

The objectives were generally reached by each company, although the poor condition of several of the structures presented limiting factors.

Types of Structures

Of the thirteen buildings used in the tests less than half had interior plastered walls and ceilings. The other interiors were formed by tongue and groove paneling, plaster board, or a combination of the two. Exterior walls consisted of wood siding or asphalt composition. Most of the roofs were covered with asphalt composition material.

These structures were similar to many of the dwellings found in the older sections of the city.

Pre-Fire Conditions

The efficiency of the indirect method depends largely on the tightness of the building; however, such confinement makes it more difficult to enter, after knockdown, because of greater heat retention.

Over 100 fires were kindled and allowed to gain headway, with some fires reaching a temperature of 1000 degrees at floor level, before being attacked and knocked down to the overhaul stage. Fire areas, using one or two rooms, ranged from 1000 to 8500 cubic feet, and were limited by standard wood doors or similar closures. Broken windows were covered partially or entirely with light wood or plasterboard. Scrap lumber and old furniture comprised the "fireload" and generally exceeded that of a comparable occupancy. About three-fourths of these fires would be classed as an "over \$500 loss" in a like occupancy.

Plan of Attack

Each attack varied somewhat according to the problem, but in using the indirect method, the general plan was as follows:

1. A hot fire was allowed to develop to simulate those conditions found in actual practice where fires have been burning for some time.
2. Use a single 1 inch line of sufficient length to adequately cover the structure.
3. Use a 1 inch mystery nozzle in conjunction with a shut-off butt in order to maintain a constant pre-set spray cone.
4. Prevent vertical ventilation and control horizontal ventilation.
5. Apply the stream through a window or door and direct the water above the seat of the fire and into the heat near the ceiling.

Pressure and Discharge

When conditions were right the indirect method was effective and very little water was used to knock down the fire.

During these test no attempt was made to accurately determine the GPM discharge from the 1 inch mystery nozzle pre-set at the spray cone. However, from the standpoint of practical fire fighting, very little water was used and water damage could be classified as negligible.

Three pump pressures were used: 125, 250, and 400 pounds per square inch. A rough estimate of the GPM discharge would be 25, 35, and 45 respectively.

The Actual Tests

The following examples represent the typical operations of one particular Engine Company:

The building involved--- 5 room wood frame, plaster interior and composition roof. Fire area, 2 rooms of approximately 5000 cubic feet with the addition of scrap wood to comprise the "fire-load." Wood doors in place, ceiling tight, and 75 percent of the window area covered with wood boards. Each fire was kindled and allowed to develop until the necessary heat was obtained.

Trial #1 Engine pressure 125 lbs.

The fire was kindled and a hot fire allowed to develop. Water spray was then directed---at a pre-set 30-degree cone--into a side window and above the seat of the fire. (A similar attack could have been made through the door.) The main body of fire was knocked down in 9 seconds without ventilating the fire area. The line was shut down and the men immediately entered the building without difficulty. Some deep seated fire remained in the scrap wood and the presence of hot vapors was noticeable.

Trial #2 Engine pressure 250 lbs.

The fire was rekindled by the addition of more fuel and allowed to develop until the flames were rolling out of the windows. A wide-angle fog cone was used to knock down the exterior fire and permitted the men to gain access to a front window. The 30 degree cone was then directed in the window as in Trial #1. In 10 seconds the main body of fire in both rooms was knocked down.

The line was shut down and the men immediately entered the rooms through the doorway, but were forced to a crouched position. because of the hot vapors. There was some smoldering fire in the scrap material and some moisture on the floor, but no standing water. Heavy char was present and the ceiling began to fail. The men took some punishment in gaining access into the fire area.

Trial #3 Engine pressure 400 lbs.

The fire was rekindled, as before, and allowed to develop until the fire extended from the windows and had entered the attic and ignited the roof. The doors began to fail.

In gaining access to a front window, an approach was made with the wide-angle cone, but the men took some punishment due to smoke and heat. The wide-angle spray was directed in the window and it limited the room fire, but could not check the spread into the attic --- reducing the cone angle increased penetration, but had little effect on the attic fire.

At this point, in spite of the increased engine pressure, it was necessary to revert to the conventional method, because of vertical ventilation and fire extension. Using the conventional method, the men entered the fire area and noticed that the ceiling had begun to fail and water was standing on the floor. With the 1 inch line they were able to cool and control portions of the rooms, but were forced to withdraw after taking considerable punishment.

A single 1-1/2 inch line with a mystery nozzle attached was then used and handled the fire successfully without undue punishment to the men.

Evaluating the Results

The following results of the indirect method were fairly predictable:

1. Time required for knock down and the amount of water used was proportionate to the degree of ventilation present.
2. Cross ventilation accelerated the fire but did not nullify the method.
3. Results were favorable even when openings comprised 25 percent of the outer wall space, providing the openings were distributed.
4. The degree of success or failure varied widely with the amount of attic space involved and the ability of the roof covering to hold. ---With the failure of the ceiling but not the roof, the problems of inaccessibility and increased cubic volume produced undesired effects.
5. With a small vertical opening present, the fire could still be knocked down by the indirect method but some difficulty was encountered. Anything more than a minimum vertical opening required the use of the conventional method to knock down the fire.

6. The procedure used in the vented fire (Trial #3), was to:
 - (a) Use the conventional method. ---Stream directed at the seat of the fire.
 - (b) Use the wide-angle spray for protection in the approach, and the narrow cone or straight stream for penetration.

A close aggressive attack overcame some of the disadvantages due to loss of confinement; but because of maximum punishment to the men, it was necessary to use a heavier line. Limitations had been reached.

Conclusions

In these drills, it was possible to control the area of the fire, the fire load, amount of pre-burn, and venting conditions. However, quality of construction, degree of building deterioration, and external wind and weather conditions were beyond control. Consequently, specific conclusions cannot be drawn. With the above conditions in mind, the following are general conclusions:

1. Two conditions are necessary if the indirect method is to be successful:
 - (a) A fire area which has not vented vertically, and preferably not at all;
 - (b) A hot fire with an accumulation of heat.
2. When the above conditions are present in a relatively small and confined area, a quick knock down may be effected with little water damage, less fire damage, and less punishment to the men than if the conventional method is used. --- A like result in the field may be expected.
3. The indirect method requires the deviation from two basic principles of fire fighting:
 - (a) Water is NOT applied at the seat of the fire; but above the fire through the hot gases and near the ceiling.
 - (b) All vertical ventilation is delayed until the fire is knocked down.
4. The stream should be placed through a small opening and directed above the fire in the form of a cone spray. ---Indirect method..
5. The indirect application of water is practical at 125 psi engine pressure, but the efficiency is increased with higher pressures.

6. Most of the stream and vapor traveled upward with very little movement horizontally or downward.
7. When operating at high pressures, the mystery nozzle should be pre-set at the desired spray cone and the water controlled at a shut-off placed in back of the nozzle.
8. Incomplete extinguishment, as in Trial #3, was due to the volume of fire in relation to the cone of protection rather than to the degree of heat present.
9. The use of the indirect method does not affect the choice of size of hose to use on any future fires. Regardless of the method used, conventional or indirect, a 1 inch line should be used ONLY when the size of the fire warrants. Even then small lines should be backed up by larger lines as required.

Questions for Discussion

1. What effect, if any, would the use of the indirect method have on the operations of Truck Co.'s?----Salvage Co.'s?-----Two Piece Engine Co.'s?-----
2. Could the indirect method be used with a larger line?
3. Could other than high pressure companies use the indirect method?
4. What affected the limitations of the 1 inch line using the conventional method?
5. What conditions are necessary for the indirect method to be successful?

NOTE: It is important to emphasize that the information in this bulletin is not to be interpreted as procedures to replace standard methods of fire fighting. It is merely information to aid you in becoming more familiar with the use of 1 inch lines on interior fire fighting.