

Fireman's Training Manual

Basic 20 Hour Course

Compliments of Bureau of Vocational Education

FIRST MEETING

**Opening - Introduction by Mayor, Fire Chief,
or
Safety Commissioner**

**Instructors Explain Program and
School Outline**

Roll Call

**Minor Extinguishment
and
Basic Division of Fire Fighting Tactics**

IM-3-67

This copy has been prepared by the Bureau of Vocational Education and paid from state funds.

PRINCIPLES OF COMBUSTION—CHEMISTRY OF FIRE

FIREMAN'S TRAINING

DEFINITION OF FIRE: Fire is the heat and light that comes from a burning substance. By burning, we mean the rapid combination of oxygen with other substances so that heat and light are produced.

HEAT OF COMBUSTION: Heat is caused by many factors which cause combustion. The heat of combustion is the total amount of heat given off when a substance burns. "Measured in Calories".

Combustion is usually thought of only in connection with fire, but it also includes many other chemical reactions, (Oily rags are such), which generates it's own heat, fed with oxygen which creates fire.

TEMPERATURE: Ignition temperature, a degree of temperature is when a combustible fuel of substance ignites. This is the temperature, at which the vapor being given off by a substance will ignite spontaneously. In the air the substance does not have to be heated to this ignition temperature throughout, to ignite.

EXPLOSIVE RANGES: Explosive ranges are termed more in connection with flammable liquids, gases, or unburned gases when improper ventilation occurs. The range is also concerned with type liquid involved, be it volatile or not, and proper mixture of vapor and oxygen, the amount being used and space concentrated.

OXIDATION: Oxidation often oxygen unites with other substances at such a low rate that little heat and no light are given off, when this happens, we call this process oxidation rather than burning or combustion.

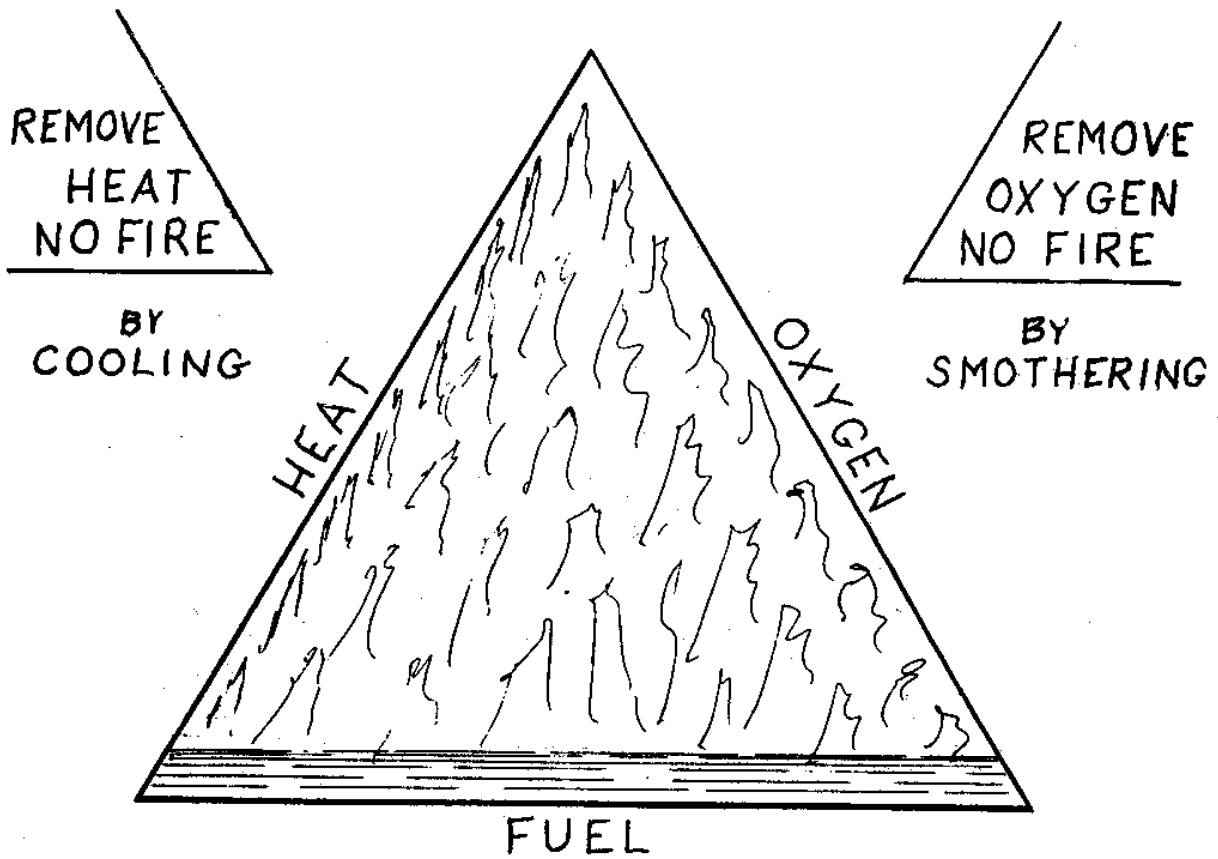
CONDUCTION: Heat is transmitted by conduction. Heat is transferred through a substance by direct contact, thus a concrete wall, a thick steel bulkhead, with a fire on one side causes heat to be given off in adjoining compartments through the steel by conduction. Example "Hot water pipes-Steam Radiators".

CONVECTION: The heated air and gases rise from a fire bringing heat to all other combustible substance within reach, such as extreme heat rising causing paper or rags to burn with proper mixture of oxygen of such cases as windows break.

RADIATION: Heat is transmitted in all directions and no medium required. It is this radiation which causes the feeling of heat when standing before an open fire.

CHEMISTRY OF FIRE

THE FIRE TRIANGLE



CLASS A—Wood, Rubber, Trash, Etc.

B—Gasoline, Oils, Paints, Thinners, Etc.

C—Electrical

D—Metals

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Fireman's Training

Second Meeting

Unit 1: Common Tools, Names, Uses

Related Information

Names

1. Pick axe
2. Peter Pirsch door opener
3. Detroit door opener
4. P. and Q. door opener
5. Sledge hammer
6. Bar cutters, two types - Voleske No. 15 rod and steel cables up to $\frac{5}{8}$ "
Voleske No. 17 rod and steel cables up to $\frac{3}{4}$ "
7. Wall pick, or hammer head pick
8. Wrecking bar
9. Claw tool
10. Buster bar
11. Hux bar
12. Kelly tool
13. Pull down hook
14. Pinch bar
15. Battering ram
16. Prompier hatchet
17. Spanners
18. Electric wire cutters - Steck No. 10 both handles insulated
Steck No. 11 both handles insulated
19. Hydrant wrenches - straight, adjustable, ratchet

20. Roof cutters (rotating cutting disc) (can opener)
21. Hand lights
22. Ceiling hook or pike pole
23. Plaster hook
24. Ladder anchor
25. Ladder board
26. Hose clamp
27. Hose jacket
28. Hose patch
29. Rope hose tool and safety belts
30. Hose strap
31. Hose roller
32. Wood auger
33. Smoke ejectors

Care of Tools

The individual departments should set up rules concerning the care of all tools. These rules should conform with recommended safety regulations.

Precaution should be taken in carrying tools in hand to protect both the carrier and other workmen. By no means should an axe or any other edged or pointed tool be carried on the shoulder.

The factor of safety, more than any other factor, should determine the method by which common tools are carried.

References:

- Fire Service Training, Unit 1, pp. 3-4
- Oklahoma A. & M. College, Stillwater, Oklahoma
- Fire Service Training, pp. 107-122
- Ohio State College, Columbus, Ohio
- Fire Service Training Manual, Chapter 2
- University of Maryland, College Park, Md.

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Unit 1: Ropes

Related Information

Fire Service Knots and Hitches

There are really only about eight knots that firemen need to know.

They are:

1. Half hitchUsed for safety
2. Square knotRescue and first aid
3. Clove hitchUsed on tools and other objects
4. Bowline on bightRescue work only
5. BowlineTools and rescue work
6. Chimney hitchAnchoring hose lines
7. Sheep shank.....Takes up slack in ropes
8. Becket Bend.....Lengthen rope

There are many combinations and adaptations of the above, such as tackle knots, running bowline, etc., likewise there is more than one way of tying most of these knots.

It is extremely difficult to tie a knot from a picture; the various uses of the knots will be shown under hoisting and in conjunction with hose and ladder procedures.

Demonstration: Tying Knots

References:

- Fire Service Training, 1955 edition, pp. 34-46
- Oklahoma A. & M. College, Stillwater, Oklahoma
- Fire Service Training, pp. 80-95
- Ohio State College, Columbus, Ohio
- Fire Service Training Manual, Chapter 10
- University of Maryland, College Park, Md.

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Firemen and Electricity

Because of several recent requests for information on safe distances from energized power lines and equipment while using fire hose we are giving you information as contained in the National Board of Fire Underwriters Bulletin No. 91, as follows:

"The only non-conducting extinguishing agents, considered safe to use around electrical circuits at close range, are carbon dioxide, dry chemical, and carbon tetrachloride or similar vaporizing liquids.

Some types of nozzles are adjustable for their fog or solid streams, so care should be exercised in the use of these nozzles so that the operator does not play a solid stream at too close a distance. When water is to be used on electrical fires, the National Fire Protection Association recommends that a fixed fog nozzle be used so the firemen cannot accidentally change from fog to a solid stream and be in a position too close for safety for this type of stream.

For ordinary lighting wires of 120 volts, to ground the nozzle can be within a few inches of the charged wire. For such voltages as ordinarily used for trolley service, there is 550 volts, the nozzle can be handled without discomfort at a point three to four feet from the wire.

SOLID STREAM (Fresh Water)

Voltage	Safe Distance	Safe Distance
	1— $\frac{1}{8}$ " Nozzle	1— $\frac{1}{2}$ " Nozzle
	Feet	Feet
1,100	6	9
2,200	11	16
3,300	15	22
5,500	18	27
6,600	19	29
11,000	20	30
22,000	25	33
33,000	30	40

These tables apply to fresh water; sea or salty water or the discharge from a soda acid extinguisher may have such high conductivity that no rule can be applied as to the safe distance for a solid stream. If it becomes necessary to use water known to have a high conductivity, then the stream should be broken up.

FOR FOG STREAM(Fresh Water)

Voltage	Safe	Voltage	Safe
	Distance		Distance
	Feet		Feet
7,500	.5	88,000	4.5
15,000	1.5	110,000	5.5
25,000	1.5	132,000	6.5
37,000	2.0	154,000	7.5
50,000	2.75	187,000	9.0
73,000	4.0	220,000	10.5

Even on lower voltages, a fireman should always try to maintain a distance of at least 3 feet when using fog and 10 feet when solid streams.

The distance given in the above tables are minimum and are considered safe under normal circumstances.

A study of the above tables will indicate that, from the standpoint of safety to the fireman, when either intentionally or unintentionally directing water on a charged conductor, the fog-type nozzle is preferred.

References:

National Board of Fire Underwriters, Bulletin No. 91
Kentucky Utilities Bulletins

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Appliance is rated in horsepower figures—one horsepower equals 1,00 watts.

Appliance	Wattage
Roaster	1,650
Toaster	1,100
Coffee Maker	1,000
Grill or Waffle Iron	1,000
Ironer	1,650
Hand Iron	1,000
Home Freezer	350
Refrigerator	150
Radio	100
Color TV	500
Television	300
Room Cooler— $\frac{3}{4}$ ton	1,250
Vacuum Cleaner	150
Furnace Mechanism	800
Bathroom Heater	1,500
Floor Polisher	200
Sun Lamp	400
Motor— $\frac{1}{2}$ horsepower	500

The total drain on any one circuit can't exceed that circuits capacity.
The standard general purpose circuit has a capacity of 1,800 watts.

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Third Meeting

Unit 3: Fire Hose

Related Information

Hose:

1. Purpose and care of fire hose
2. Types of fire hose
3. Sizes of fire hose

Hose Couplings:

1. Types and care of couplings
2. Connecting couplings

Hose Loads:

1. The horse shoe load
2. The accordian load
3. The combination load

Hose Lays:

1. The straight lay
2. The reverse lay

Hose Carries

References:

International Fire Service Training—Hose Practices
Oklahoma State University, Oklahoma

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Unit 1: Forcible Entry

Basic Course on Forcible Entry

Different Practices of Forcible Entry

1. Opening doors
2. Opening windows
3. Opening roofs
4. Opening floors
5. Opening ceilings
7. Breaking glass
6. Opening skylight

Demonstrate, if Available, Forcible Entry Practices

Questions

1. When should forcible entry be put into action ?
2. Name some common tools used in forcible entry.
3. What must a fireman guard against in forcible entry ?
4. Explain the usual construction of wood floors.
5. What two tools are used in opening a ceiling from below ?

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Unit 2: Ladders

Related Information

Carry ladder to heel, roof ladder to head.

Pick up ladder.

Erect ladder on a 75 degree angle.

Be sure locks, dogs or pawls are locked.

Anchor ladder to window or to roof

Anchor ladder by using ladder anchor, hose strap, hose chain or rope hose tool.

When climbing ladder, coordinate body.

When climbing ladder, use hands on rungs, not beam.

When passing on ladder, man going up climb on the right side, man coming down descend on left side.

Go off ladder on right side, come onto ladder on opposite side. (If possible)

References:

International Fire Service Training

Oklahoma State University, Stillwater, Oklahoma

Fire Service Training University of Ohio, Columbus, Ohio

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Unit 2: Ladders

Related Information

Commands to be given on ladder carry and raise.

1. Remove ladder from apparatus
2. Prepare to carry ladder
3. Carry ladder
4. Halt
5. Prepare to lower ladder
6. Lower ladder
7. Prepare to raise ladder
8. Raise ladder
9. Extend fly (if extension ladder)
10. Halt
11. Lock paws or dogs
12. Lower into building

Reference:

International Fire Service Training--Ladders
Oklahoma State University, Stillwater, Oklahoma
Fire Service Training Manual
Ohio State College, Columbus, Ohio

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Unit 2: Ladders

Related Information

Care of Ladders:

Inspect ladder after every use and at regular intervals.

Clean ladders at regular intervals.

Keep wood ladders free of splinters.

Sand and shelac wood ladders frequently.

Replace halyard or fly rope frequently.

Test ladders annually.

If metal ladder is sprung, do not use.

If wood ladder is split or otherwise damaged, do not use.

References:

International Fire Service Training—Ladders

Oklahoma State University, Stillwater, Oklahoma

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Unit 2: Ladders

Job 1: Carry and Erect a Roof Ladder

Operations:

1. Remove ladder from apparatus.
2. Release hooks.
3. Place ladder on shoulder and carry to location to be used.
4. Remove ladder from shoulder.

Directions:

1. Push in on hooks and turn toward ground.
2. Face heel of ladder at fifth rung from head.
3. With hand next to ladder, grasp rung at opposite beam.
4. Raising ladder, turn toward head.
5. Run arm between the rungs, placing ladder on shoulder.
6. Carry ladder to roof.
7. Lay ladder on roof, hooks down.
8. Push ladder up roof, and secure hooks over peak.

Reference:

International Fire Service Training—Ladders

Oklahoma State University, Stillwater, Oklahoma

National Fire Protection Association—Handling Hose and Ladders

Boston, Massachusetts.

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Unit 2: Ladders

Job 2: Carry an Extension Ladder (2 men)

Operations:

1. Remove ladder from apparatus.
2. Place ladder on shoulder.
3. Carry ladder to location to be used.
4. Remove ladder from shoulder.

Directions:

1. One man at heel and one man at head of ladder.
2. Each man face the head of the ladder at the second rung from end.
3. With hand next to ladder, grasp the second rung at opposite beam.
4. Raising ladder, turn toward heel.
5. Run arm between rungs.
6. Place ladder on shoulder.
7. Grasp the second rung, from the shoulder, in the center.
8. Carry to location.
9. Remove ladder from shoulder by reversing the above.

References:

International Fire Service Training—Ladders

Oklahoma State University, Stillwater, Oklahoma

National Fire Protective Association—Handling Hose and Ladders

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Unit 2: Ladders

Job 3: Raise Extension Ladder (2 men)

Operations:

1. Remove ladder from apparatus.
2. Carry to location.
3. Raise ladder.

Directions:

1. Heel man place a foot on each beam and grasp the second rung.
2. The head man face the direction of the head of the ladder, grasp the second rung from the head in the center.
3. Raise head of ladder shoulder high.
- 4 Turn and step under ladder.
5. Raise ladder to vertical position by walking in under the ladder, grasping every other rung with each hand.
6. Head man anchor ladder, if fly out. If fly in, vice versa.
7. Heel man extend fly, if fly out. If fly in, vice versa.
8. Head man observe head of ladder and give orders when fly extends sufficiently, if fly is out. If fly is in, vice versa.
9. Heel man let ladder in to building, head man guide ladder.
10. Check for correct angle.
11. Place ladder board under ladder.

References:

International Fire Service Training—Ladders

Oklahoma State University, Stillwater, Oklahoma

National Fire Protection Association Handling Hose and Ladders

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Unit 4: Salvage Practices

Related Information

Fire salvage organization

Value in public relation

Salvage equipment

Types of salvage covers

Sizes of salvage covers

Salvage cover folds

Salvage over throws

Salvege cover shutes

References:

International Fire Service Training—Salvage

Oklahoma State University—Stillwater, Oklahoma

National Fire Protective Association

Boston, Massachusetts

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Unit 7: Ventilation

Related Information

Definition of Ventilation:

Ventilation is a planned and systematic removal of smoke, gases and heat from a structure or an involved area.

Purpose of ventilation:

Aids life saving and rescue.

Speeds attack and extinguishment.

Reduces the dangers of back draft or smoke explosion.

Situations requiring ventilation:

A smoldering fire.

A closed building.

A smoke filled building.

References:

International Fire Service Training—Ventilation Practices

Oklahoma State University—Stillwater, Oklahoma

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Unit 8: Rescue Techniques

Related Information

Methods of Rescue

One man assist.

Two men assist.

One man carry on back. (Crawl or on hands and knees).

Arms carry. (one man)

One man drag. (Astride victim)

One man drag descending inclines.

Personal Protection

All Service Filter Type Mask. (must have 16% of oxygen.)

Air Pack Type Mask. (carries its own air).

Oxygen Generating Type Mask. (makes it's own oxygen.)

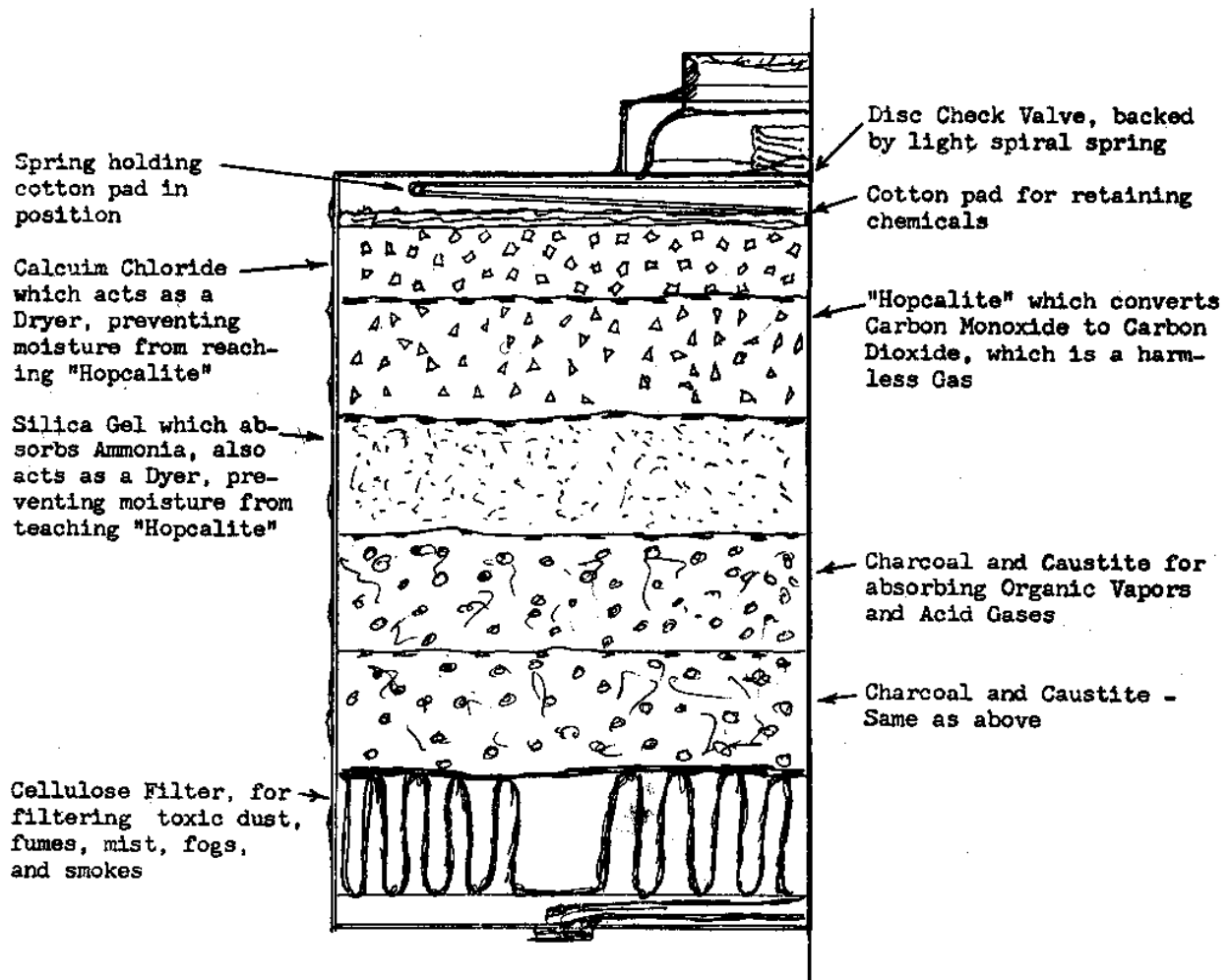
REFERENCE:

International Fire Service Training—Rescue
Oklahoma State University—Stillwater, Oklahoma

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Canaster of an All Service Gas Mask



CANASTER FOR "ALL SERVICE" MASK

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Unit 6: Fire Apparatus Practices

Related Information

The Quadruple Combination pumper

Commonly referred to as "Quad," this type pumper is a Combination of triple Combination and service pumper.

The Quadruple Combination consists of:

- A. Pump
- B. Booster Tank
- C. Hose
- D. Ladders

The purpose of the combination is to combine in one piece of apparatus all equipment needed for general fire fighting.

References:

Fire Service Training, P. 7

Oklahoma A. & M. College, Stillwater, Oklahoma

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Unit 6: Fire Apparatus Practice

Related Information

The Triple Combination pumper

The one piece of fire fighting apparatus found in smaller departments is an example of a triple combination pumper.

It contains:

- A. A pump
- B. A booster tank
- C. A good supply of hose

In addition, the triple combination pumper carries a 24 and/or 35 foot extension ladder, a roof ladder, forcible entry tools, and such other equipment as may be added by the department. Such as duplex couplings, cooper leak stop, hose clamp, adapters, hose roller, nozzles, minor extinguishers, hydrant wrenches, axes, crow bars, gas masks, ropes, rope hose tools, ladder boards, ladder anchors, etc.

References:

- Fire Service Training, p. 5
- Oklahoma A. & M. Stillwater, Oklahoma

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Unit 5: Fire Streams Practices

Related Information

Fire Streams

Three type of streams as to their nature, may be produced with modern nozzles, providing you are up on your pressure chart.

They are:

- A. Solid streams
- B. Broken streams
- C. Fog streams

In addition to these, firemen think of fire streams in terms of size or volume and we have:

- A. Small streams up to and including booster lines.
- B. Hand streams—1½" and 2½" hose lines, using up to 1¼" tip.
- C. Master streams—anything larger than 1¼" tip or that cannot be operated by hand.

Let us look at each of these so we may be able to identify them know their characteristics and possibilities.

References:

- Fire Service Training, Unit 5, pp. 12-13-14
- Oklahoma A. & M. College, Stillwater, Oklahoma
- Fire Service Training, pp. 202-203
- Ohio State College, Columbus, Ohio
- Fire Service Training Manual, Chapter 12
- University of Maryland, College Park, Md.

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Unit 5: Streams

Related Information

PUMP PRESSURE REQUIRED TO MAINTAIN 100 lbs.

NOZZLE PRESSURE ON 2½" HOSE

Hose Length	100	200	300	400	500	600	700	800	900	1,000			
	PUMP PRESSURE										GPM	WPM	
NOZZLE SIZE	¾"	55	60	65	70	75	80	85	90	95	100	118	985
	⅞"	58	66	74	82	90	98	106	114	122	130	159	1328
	1"	60	70	80	90	100	110	120	130	140	150	209	1745
	1½"	68	86	104	122	140	158	176	194	212	230	265	2213
	1¾"	75	100	125	150	175	200	USE	2	LINES	326	2722	

2—1½" Lines (Leader) with ½" Tip same as

1—2½" Line with ¾" Nozzle 104 868

1—2½" Lines (Leader) with 90 GPM Tip Same as

1—2½" Line with 1" Tip 180 1503

When using 1½" leader lines off wye, use 100 pounds nozzle pressure.

To obtain 100 pounds nozzle pressure add 50 pounds to above pressure.

Add 5 pounds for each 12 feet nozzle is raised above pump.

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Unit 5: Streams

Related Information

**PUMP PRESSURE REQUIRED TO MAINTAIN 100 lb.s.
 NOZZLE PRESSURE ON 1½" HOSE (connected to pumper)**

GPM FLOW	F. L. Each 100'	50	100	150	200	250	300	350	400	450	500	*WPM
60	11 lbs.	105	111	116	122	128	133	139	144	150	155	501 lbs.
70	15 lbs.	107	115	122	130	137	145	152	160	167	175	585 lbs.
80	20 lbs.	110	120	130	140	150	160	170	180	190	200	668 lbs.
90	24 lbs.	112	124	136	148	160	172	184	196	208	...	752 lbs.
95	27 lbs.	114	127	141	155	169	183	197	211	...	...	793 lbs.
100	30 lbs.	115	130	145	160	175	190	205	...	...	...	835 lbs.
110	37 lbs.	118	137	155	174	192	210	...	...	...	...	919 lbs.
120	45 lbs.	123	145	168	191	214	...	...	...	...	...	1002 lbs.
125	50 lbs.	125	150	175	200	225	...	...	...	...	...	1044 lbs.

If hose connected to 1½" pre-connect outlet, add pipe loss.

*WPM—weight (in pounds) per minute

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Fifth Meeting

Unit 6: Fire Apparatus Practices

Job 1: Prepare Pumper to Pump from draft.

Operations:

1. Spot pumper at water supply.
2. Prepare pumper to draft.

Directions:

1. Place pumper on solid level ground at the water supply.
2. Attach strainer with rope attached to hard suction hose.
3. Remove cap from pump intake.
4. Assemble hard suction hose and attach to pump intake.
5. Submerge strainer end of hose in water.
6. Attach outlet hose to outlet.

Technical Information:

Submerge strainer at least 18 inches under water. Avoid high lift.
Keep strainer off bottom of water supply.

References:

International Fire Service Training—Apparatus Practices
Oklahoma State University, Stillwater, Oklahoma

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Unit 6: Fire Apparatus Practices

Job 2: Pump from Draft

Operations:

1. Engage pump.
2. Prime pump.
3. Charge discharge line or lines.

Directions:

1. Engage road transmission in pump gear.
2. Engage pump transmission.
3. Activate priming device.
4. When pump is primed, release priming device.
5. Turn throttle and develop 50 lb. pressure on outlet gauge.
6. Slowly open discharge valve and maintain 50 lb. pressure on outlet gauge.
7. Set change over valve in proper position.
8. Obtain engine pressure necessary to give desired nozzle pressure.
9. Set pressure regulator.
10. To shut down, reverse procedures.

Technical Information:

Avoid excessive engine speed when priming. Observe all gauges while pumping.
Always flush pump after pumping from draft.

References:

International Fire Service Training—Apparatus Practices
Oklahoma State University, Stillwater, Oklahoma

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Unit 6: Fire Apparatus Practices

Job 3: Spotting and preparing pumper to pump from hydrant

Operations:

1. Spot pumper at hydrant.
2. Prepare pumper to pump from hydrant.

Directions:

1. Place pumper correct distance from hydrant at correct angle.
2. Remove hydrant cap.
3. Remove pump intake cap.
4. Obtain suction hose and connect to hydrant and pumper.
5. Open hydrant.
6. Connect discharge hose to discharge outlet.

Technical Information:

Open hydrant slowly and all the way. Stop pump intake short of the hydrant.

Have a curve in suction hose, either soft or hand. Avoid kinks in soft suction hose, always use chafing block on suction hose.

References:

International Fire Service Training—Apparatus Practices

Oklahoma State University, Stillwater, Oklahoma.

Fire Service Training

Ohio Trade and Industrial Education Service, Columbus, Ohio

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Unit 6: Fire Apparatus

Job 3: Pumping from hydrant

Operations:

1. Operate pump.
2. Charge discharge line or lines.
3. Shut down pump.

Directions:

1. Engage road transmission.
2. Engage pump transmission.
3. Open outlet valve or valves.
4. Set changeover valve.
5. Obtain engine pressure necessary to give desired nozzle pressure.
6. Set pressure regulator.
7. To shut down, reverse procedures.

Technical Information:

Open and close all valves slowly. Never let residual pressure drop below 5 pounds. Set changeover valve each time pump is used. Set pressure regulator each time pump is used.

References:

International Fire Service Training, Apparatus Practices
Oklahoma State University, Stillwater, Oklahoma
Fire Service Training
Ohio Trade and Industrial Education Service, Columbus, Ohio

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