



Fire Protection Training

Procedures Handbook 4300

PUMPING

TOPIC: Pump Cavitation

TIME FRAME: 30 Minutes

LEVEL OF INSTRUCTION:

BEHAVIORAL OBJECTIVE:

Condition: A written quiz

Behavior: The student will be able to describe pump cavitation and describe how to prevent pump cavitation.

Standard: With a minimum of 70% accuracy

MATERIALS NEEDED:

- Chalkboard and chalk
- Flipcharts
- Markers
- Appropriate visual aids
- Audio visual equipment

REFERENCES:

- IFSTA, Fire Department Pumping Apparatus, 7th Edition, Chapter 6

PREPARATION:

Understanding pump efficiency and the adverse effects of cavitation may save an operator from destroying a pump.



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PUMP CAVITATION

PRESENTATION

APPLICATION

I. PUMP EFFICIENCY

- A. If a Pump Is Operating Properly an Increase in Engine RPM's Will Result in a Corresponding Increase in Pump Pressure
- B. Cavitation
 - 1. A condition whereby an increase in engine RPM's is not accompanied by a corresponding increase in pump pressure
 - 2. Cavitation process description
 - a. At normal atmospheric pressure (14.7 psi at sea level) water boils at 212 degrees fahrenheit
 - b. In a pump, particularly on the suction side, if insufficient water is introduced the pressure drops significantly
 - c. In this low pressure state water within the pump boils at a lower temperature. The lower the pressure within the pump the lower water's boiling point
 - d. As a molecule of water encounters this lowered boiling temperature condition it boils violently and is converted to water vapor or steam as the molecule expands. This expansion is characterized by air bubbles.
 - e. As these air bubbles reach the impeller and approach the volute they encounter a high pressure condition within the pump which causes the boiling temperature of the water to increase.

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PRESENTATION	APPLICATION
<ul style="list-style-type: none">f. Since the molecule of water which was boiling in the low pressure area can no longer boil in the high pressure area (i.e., the boiling temperature rose as the pressure rose) the water molecule condenses and the air bubble collapses.g. Other water molecules which were previously under higher pressure rush into this new low pressure area or vacuum created by the collapsing bubbles at great velocity.h. The tremendous force or shock waves created as these water molecules crash into each other and ultimately the pump casing or the impeller can cause serious pitting of the metal components within the pump.i. the cavitation condition is not corrected pitting can destroy an impeller in a relatively short period of time.	
<p>II. CAUSES OF CAVITATION</p> <ul style="list-style-type: none">A. Restriction in the Suction Hose<ul style="list-style-type: none">1. Hose too small2. Kink in suction hose3. Blockage of hose or suction strainerB. Suction Hose Too LongC. Lift Too GreatD. High ElevationE. Pumping Hot WaterF. Exceeding Pumps Capability	

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III. SIGNS OF CAVITATION

- A. Increase of Engine RPM's Without Corresponding Increase in Pump Pressure
- B. Pinging or Banging Noise

IV. CORRECTING CAVITATION CONDITION

- A. Increasing the Amount of Water Available to the Pump
 - 1. Remove blockages or restrictions to suction inlet
 - 2. Reduce height of lift
 - 3. Reduce length of supply hoseline
- B. Decrease Engine RPM's
- C. Decrease Number of Hoselines

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PUMP CAVITATION

SUMMARY:

Cavitation is a serious problem in pumping operations. If not guarded against and corrected in timely fashion, it can cause pump failure. This failure will jeopardize current firefighting operations and can place the apparatus out of service for an extended period of time.

EVALUATION:

A written quiz.

ASSIGNMENT:

To be determined by instructor(s).