***TOPIC:*** Auxiliary Cooling Systems

***TIME FRAME:*** 30 Minutes

***LEVEL OF INSTRUCTION:***

***BEHAVIORAL OBJECTIVE:***

*Condition:* A written quiz

*Behavior:* The student will list and describe the purpose and operation of auxiliary cooling systems.

*Standard:* With a minimum 70% accuracy

***MATERIALS NEEDED:***

- Appropriate visual aids
- Audio visual equipment

***REFERENCES:***

- IFSTA, Fire Department Pumping Apparatus, 7th Edition, Chapter 5

***PREPARATION:*** Fire ground pumping operations are done under extreme weather conditions which put extra strain on an engine cooling system. Long duration stationary pumping or off-road pumping may create additional difficulties for the cooling system to handle. For these reasons auxiliary cooling devices have been designed to provide additional cooling for the engine and transmission.

| PRESENTATION | APPLICATION |
|---|---|
| **I. ABNORMAL HEAT CONDITIONS** | |
| A. Extended Pumping Periods | What are some reasons for auxiliary cooling systems? |
| B. Stationary Pumping Operations | |
| 1. Limited air movement over engine and transmission cooler | |
| 2. Especially on skid mounted pump equipment | |
| C. High Ambient Temperature Pumping Operations | |
| 1. Summer temperatures in excess of 100 degrees F can cause extreme engine heat build up | |
| D. Off-Road Pumping | |
| 1. PTO operations place additional stress on engine | |
| 2. Operations are conducted at low speeds adversely affecting intake of air | |
| E. Automatic transmissions are prone to overheat on pump and roll operations | |
| **II. INDIRECT COOLER** | |
| A. Water from Fire Pump Does Not Mix with Radiator Coolant | |
| 1. Water from pump travels through tubing coil | |
| 2. Radiator coolant flows around tubing inside a water jacket | |
| 3. Radiator coolant is not contaminated | |

| PRESENTATION | APPLICATION |
|---|---|
| B. Engaged by Opening Auxiliary Cooling Valve on Pump Panel | |
| 1. Water from discharge side of pump goes into coil | |
| 2. This water absorbs heat from radiator coolant flowing around the coil of tubing | |
| 3. This process is called "heat exchange" | |
| 4. Water then returns to suction side of the pump | |
| C. Should be Utilized Whenever | |
| 1. Going off road | |
| 2. Long duration pumping operations | |
| **III. DIRECT COOLER** | |
| A. Water from Pump Enters Directly into Radiator | |
| 1. May cause catastrophic failure of radiator due to over pressure | |
| | What are two major disadvantages of the direct cooler? |
| 2. Remove radiator cap if this system is to be used extensively | |
| 3. After use coolant is most likely contaminated - service or test | |
| B. Engaged by Opening Radiator Fill Valve on Pump Panel | |
| 1. Water flows through tubing on discharge side of pump to radiator and then out to ground | |

| PRESENTATION | APPLICATION |
|---|---|
| **IV. OIL COOLERS** | |
| A. A Series of Copper Tubes with Engine Oil in Them | |
| | How does on oil cooler work? |
| 1. Air or water flows around tubes | |
| 2. A "heat exchanger" | |
| B. Seldom Have Any Operator Controllable Features | |
| **V. TRANSMISSION COOLER** | |
| A. On Automatic Transmissions | |
| B. May Be in Radiator or in Separate Heat Exchanger | |
| | Where is the transmission cooler located? |
| 1. Often a retro-fit item after heat problem identified | |
| C. Seldom Have Any Operator Controllable Features | |

***SUMMARY:***

Auxiliary coolers can provide additional cooling capacity under extreme operating conditions. The indirect cooler has definite advantages and in fact should be required in some situations. The direct cooler may be useful to add water to the radiator, but must be used with caution. Oil coolers and transmission coolers can be useful additions to pumping apparatus.

***EVALUATION:***

A written quiz.

***ASSIGNMENT:***

To be determined by the instructor(s).