UNIT VI - PLUMBING

Lesson 5: Protecting Water Pipes from Freezing

Competency/Objective: Identify methods of protecting water pipes against freezing.

Study Questions

1. In respect to pipe freezing, what factors must be considered before installing pipe?
2. What different methods are available to prevent pipes from freezing?
3. What methods are available to thaw frozen pipes?

References

1. *Agricultural Structures (Student Reference).* University of Missouri-Columbia: Instructional Materials Laboratory, 1999, Unit VI.
2. Transparency Master
   a) TM 5.1: Electric Heat Tape
3. Activity Sheet
   a) AS 5.1: Water Pipes and Freezing Temperatures

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TEACHING PROCEDURES

B. ***Review***

Lesson 4 described methods of measuring, cutting, and joining pipe for installation. An important factor to consider when installing pipes is protecting them from freezing. Designing a plumbing system to prevent freezing and providing sufficient protection for pipes are necessary because of the potential cost of damage from pipes that have split and burst. If pipes do freeze, several methods are available to heat and thaw the frozen sections of pipe.

C. ***Motivation***

Cap one end of a short section of plastic pipe, fill it with water, and cap the other end. Place this in a very cold freezer or on dry ice for a few hours. When the water in the pipe has frozen, show it to the class. It likely will have bulged and split from the expansion of the water as it turned to ice. (If time allows, students may perform this experiment themselves.)

D. ***Assignment***

E. ***Supervised Study***

F. ***Discussion***

1. Discuss the consequences of frozen pipes, referring back to the pipe used for the motivation. Explain that sections of pipe damaged due to freezing must be replaced even if water lines have to be dug up. Discuss factors to consider when installing pipe.

   In respect to pipe freezing, what factors must be considered before installing pipe?

   a) Running water lines underground below the frost line
      1) The average frost line in Missouri ranges is 3 feet.
      2) Pipes should be below the frost line.
      3) Most people install their pipes a foot below the frost line to help prevent freezing.
   b) Design of the plumbing system
      1) Designing the system so that pipes are placed in interior rather than outside walls can protect them.
      2) Insulation should be used around pipes placed near exterior walls.
         (a) R factor of 6.5 to 8
         (b) Carefully wrapped, with the ends butted together tightly and joined with tape
      3) Frost-free faucets should be used outdoors.
      4) If pipe is installed in an area subject to freezing, a drain valve should be added.

2. Discuss effective practices for preventing pipes from freezing. If possible, show a sample of electric tape and pipe insulation to the class.

   What different methods are available to prevent pipes from freezing?

   a) Wrapping exposed pipe in waterproof insulation
   b) Protecting exposed pipe from direct winds
   c) Supplying at least minimal heat to the inside of the structure using any appropriate heating system
   d) Using electric heat tape

1) The heat tape is placed along the pipe, which is then wrapped in insulation to hold the heat close to the pipe.
2) The tape carries an electrical current through it to supply heat.
3) Heat tape can be wired either with a timer set to turn it on and off at certain times or with a thermostat that activates the tape at a designated temperature.

e) Allowing water to run continuously
1) If water pressure begins to drop, the line should be opened a little so that the water runs continuously.
2) If the pressure returns to normal, the water should be allowed to drip or trickle from the faucet until the temperature rises to a safe point.

3. Ask students how they would thaw a pipe once it had frozen. Discuss the following different methods of thawing the pipe. Have students complete AS 5.1.

What methods are available to thaw frozen pipes?

a) Torches used by professional plumbers
1) If the flame comes in contact with combustible material, a fire can result.
2) Heating the pipes in one spot too quickly can cause the water to boil, creating enough pressure to cause the pipes to explode.
3) A flame should never be applied directly to a plastic pipe.

b) Electric heaters, hair dryers, heating pads, and electric blankets - should only be used after evaluating if any danger of electrical shock exists

c) Placing embers or charcoal briquettes in an appropriate container near frozen pipes for exterior pipes

G. ***Other Activities***

Ask a plumber to come and speak to the class about methods they have found effective for preventing pipes from freezing and thawing frozen pipes.

H. ***Conclusion***

Every attempt should be made to protect pipes from freezing. Placing lines below the frost line and providing insulation or other protection for any pipe that is not buried will greatly increase the odds of avoiding frozen pipes. If all efforts to prevent freezing have failed, the solution to frozen pipes is to raise the temperature enough for them to thaw by whatever safe and practical means are available.

I. ***Answers to Activity Sheet***

J. ***Answers to Evaluation***

1. a
2. b

3. The heat tape is placed along the pipe, which is then wrapped in insulation to hold the heat close to the pipe.

4. Fire and exploding pipes caused by the pressure from boiling water

5. Answers may include any two of the following: electric heater, hair dryer, heating pad, and electric blanket.

6. Drain valve

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EVALUATION

Circle the letter that corresponds to the best answer.

1. Exposed pipe should be:

   a. Wrapped with waterproof insulation.
   b. Covered with an electric blanket.
   c. Buried in dirt.
   d. Wrapped in duct tape.

2. If the water pressure begins to drop, what should be done to prevent the pipe from freezing?

   a. The outlet should be turned off.
   b. The water should be allowed to run continuously.
   c. Water to the entire plumbing system should be shut off.
   d. The pipe should be heated using a propane torch.

Complete the following short answer questions.

3. How is electric heat tape used to keep pipes from freezing?

4. What are two problems that may occur when using a torch to thaw copper pipes?

   a.

   b.

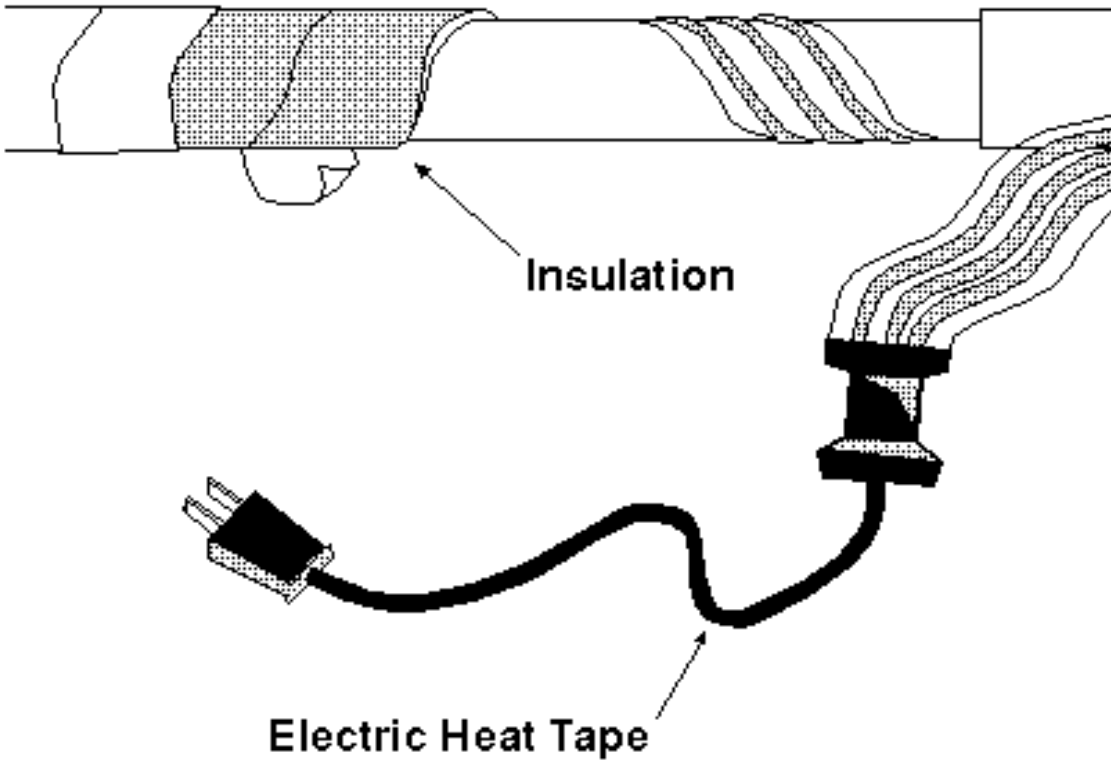
5. What are two electric devices that can be used to thaw frozen pipes?

   a.

   b.

6. What special fixture should be added if pipe is installed in an area subject to freezing?

Electric Heat Tape



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Water Pipes and Freezing Temperatures

Objective: Describe common methods for preventing freezing in water lines and for thawing pipes.

Using the questions below, interview three different homeowners or owners of agricultural operations about their experiences with frozen water lines. Record their answers here or on another sheet of paper if more space is needed. Be prepared to discuss the answers with the class.

1. Have any of your water lines ever frozen?

2. If not, what measures were taken that prevented freezing?

3. If so, where and why did the lines freeze?

4. Did any damage occur to the plumbing system? If so, what was done to repair the damage?

5. What action was taken to thaw the pipe?