Crimping

Description
Students will learn to crimp and remove cross-linked polyethylene (PEX) pipe and fittings.

Lesson Outcomes
The student will be able to:
- Connect crimp fittings and pipe to create a watertight seal
- Connect pipe and fittings to given dimensions
- Disassemble crimp fittings

Assumptions
The teacher is familiar with crimping procedures.

Terminology
Fitting: an object used to connect one or more pieces of piping material.
Crimping: the pressing together of a flexible ring to secure a watertight seal between pipe and a fitting.
Rough in: installing a piping system before it is covered and inaccessible. Rough-in piping is inspected by a local plumbing inspector before further work is permitted. Correct sizing, support, and ability to withstand water pressure are inspected.

Estimated Time
2–6 hours

Recommended Number of Students
Activities could be done individually or in pairs, depending on the availability of hand tools.

Facilities
Small individual activities could be conducted in a typical technology education shop with bench tops. Larger activities would necessitate a flat vertical surface. Stud walls or plywood would provide a realistic surface upon which students could construct projects. See the “activity” sections for greater detail.
Tools

- ½” crimping tool – Ridgid 1807 or equivalent (Figure 1)
  General rules for maintenance of crimping tools include:
  ─ Store with jaws closed.
  ─ Keep clean of dirt and oil.
  ─ Ensure correct engagement of crimp ring by use of go/no go gauge.
  Manufacturer’s documentation should be consulted for specific maintenance and instructional materials.
- Plastic tubing cutter – Ridgid PC-1250 or equivalent (Figure 2)
  Plastic tube cutter should be kept in a closed position when not in use. The blades are extremely sharp.
- Crimp ring cutter (Figure 3)
- Go/no go gauge – included with purchase of crimping tools (Figure 4)
  A go/no go gauge is used to determine the correct engagement of a crimp ring.
- Water pump pliers (Figure 5)
- Tape measure
- Test equipment: hydrostatic pump or hose connector (Figure 6)
Materials

- ½” PEX pipe (available in straight lengths of 20’ or coils of 50, 100, 500, or 1000’)
- ½” crimp rings (typically purchased by the hundred or in bags of 50)
- ½” crimp fittings. Types depend on the activity.

Resources

Detailed description of crimping
http://www.pexuniverse.com/content/how-install-pex-tubing-installation

PEX Information
http://www.pexinfo.com
Crimp Fittings

Crimp fittings are used to connect at least two pieces of PEX pipe. The most common diameter of PEX piping used is \(\frac{1}{2}\)”. Figures 7–12 show several of the most common fittings.

*Note: The solder joint must be made BEFORE crimping or the plastic will soften and leak when under pressure.
Demonstration

Working with cross-linked polyethylene (generically known as PEX) is an excellent introduction to techniques used in plumbing. The process of planning, constructing, and testing models the procedure found on job sites. It is recommended that teachers demonstrate an assembly and disassembly procedure to students and then allow them to construct several projects.

PEX piping is now commonly used for water distribution lines in British Columbia. In the past, copper water lines were the standard. However, several factors have allowed PEX to become much more common:

- Crimping PEX lines is much faster than soldering copper lines.
- The smooth interior of PEX piping offers low resistance to water flow.
- The lifespan of PEX piping is excellent.
- The cost of manufacturing PEX piping is relatively low in comparison to mining copper.

The trade-off for using PEX piping is that it is easily damaged in exposed locations and it is susceptible to melting in areas of high heat.

Assembly Demonstration

1. Cut the PEX pipe to length. It is important that piping is cut squarely.
2. Slip an unused crimp ring over the end of the pipe.
3. Fully insert the crimp fitting (Figure 13).
4. Slide the crimp ring in a distance of $\frac{1}{8}"–\frac{1}{4}"$ from the end of the pipe.
5. Squeeze the crimp ring with water pump pliers to hold it in place.

Figure 13
6. Use the crimping tool (Figure 14).

![Crimping tool](image)

**Figure 14**—Using the crimping tool

**Note:** Demonstrate use of the go/no go tool to ensure correct engagement (Figure 15). This need only be done once during the construction phase, not after every crimp. See the “Resources” section for additional online resources outlining this procedure.

![Go/no go gauge](image)

**Figure 15**—Using the go/no go gauge

**Disassembly Demonstration**

1. Remove any pressure from within the pipe.
2. Cut the pipe approximately ¾" back from its end.
3. Use crimp ring cutter to cut the ring.
4. The cut ring should be recycled (copper is valuable).
5. The small piece of pipe goes into the garbage.
6. Longer pieces of pipe can be stored for future use.
7. Fittings should be returned to their correct storage location.
Testing Demonstration

Attach a hydrostatic pump or hose connector to the piping project.

Bring the pressure up to 200 psi (1400 kpa) if using the pump; otherwise use line pressure.

The piping system should be able to withstand pressure without leakage. Should a leak occur, the most common sources of error are:

• The crimp ring was not crimped.
• The pipe was not cut squarely.
• The end of the pipe was damaged.
• The fitting was defective.

Depending on the source of the leak, students may have to re-crimp or remove a section of piping. The process of testing at the rough-in stage is important for students to understand. Occupancy of a building is not permitted unless a rough-in inspection was successful.
Activity 1: Formative Practice

Have students construct a circular loop or figure 8 with given dimensions (Figure 16). Virtually any shape could be constructed. Be sure to provide centre-to-centre dimensions for A, B, and C in Figure 16.

A: ______
B: ______
C: ______

Figure 16—PEX figure 8

Other possibilities could include a student’s initials or letters to form the name of their school. Note the individual dimensions of each project; this ensures efficient use of material.

Note: Dimensions in plumbing are normally centre-to-centre measurements.
Activity 2: Sprinkler Arrangement

Construct a free-standing arrangement of piping with a hose connector on one end and a sprinkler outlet on the other. Sprinkler outlets can be purchased at most hardware stores.

Have students construct the sprinkler assembly given in Figure 17. Be sure to provide centre-to-centre dimensions for A, B, and C.

Figure 17—PEX sprinkler system
Activity 3: Summative Activity

Construct a rough-in for several fixtures (Figure 18).

Procedure:
1. Accurately lay out the location of all piping using chalk lines and pencil.
2. Have your teacher approve the layout.
3. Install the piping accurately, using correct crimping technique.
4. Test the piping.
5. Have your teacher inspect the installation.
6. Remove the pressure and disassemble the project.

Notes:
- WC (Water Closet) will be an American Standard Cadet toilet. See specification sheet for location of water supply.
- LAV (Lavatory) will be an American Standard Ellisse sink. See specification sheet for location of hot and cold water supply.
- Given dimensions are shown to centre of fixtures.
Provide students with dimensions for A, B, C, and D in Figure 19. See the manufacturer specification sheet for the dimensions E, F, and G.

It is recommended to conduct the rough-in on a section of plywood to allow chalk lines and layout to be checked before installation occurs. Removing the challenge of drilling studs allows students to focus on laying out piping on a two-dimensional plane.
Installation Notes

- A painted plywood wall serves as an excellent surface for laying out and installing pipe. Pencil, chalk lines, and levels can be used to transfer dimensions from the given drawing to the surface. The teacher should check student layouts before allowing them to install piping.

- Time and space permitting, the plywood could be removed and piping installed within studs (as it would be in an authentic construction setting). The plywood layout would serve as a full-sized template. Should students be required to drill through studs, a Milwaukee right angle drill (or equivalent) would be required (Figure 20).

![Right angle drill](Figure 20—Right angle drill)

- Pipe should be fastened with appropriate clips. Talon clips may be used on a flat surface but are difficult to reuse. Plastic pipe clips are a better choice, as they can be screwed to a surface where necessary and easily reused.

- Piping can be tested using a hydrostatic pump or a hose connector connected to a wall hydrant.

- To present a more realistic example of rough-in specifications, actual rough-in dimensions may be used. See the referenced spec sheets for American Standard bathroom sink and toilet.
Possible Integrated Activities

- PEX water rough-in could be integrated into a full bathroom rough-in that includes a drainage system.
- Water outlets could be fabricated with soldered outlets and connected with a PEX by a solder adapter.
- Students could draw an isometric diagram of their proposed project (Figure 21).
- Students could use the PEX rough-in as part of an integrated bathroom project upon which fixtures may be connected.

![Figure 21—PEX isometric](image)

Evaluation Guidelines

The student:
- Uses appropriate safety equipment and procedures.
- Selects appropriate tool(s) for the task.
- Produces accurately cut piping to meet given dimensions.
- Produces a watertight piping system.
- Exhibits tidy housekeeping.

Acknowledgments

“½” crimp 90° elbow” photograph used by permission of Conbraco Industries Inc.