

Lesson 1: Working With Cold Metal

Using a Tap and Die Set

Objective: Students will observe how to make internal and external threads using a tap and die set.

Directions: Use a tap and die set to tap a hole and thread a rod.

Materials and Equipment:

Safety goggles or glasses*

Gloves

Portable or stationary drill and appropriate twist drill

Center punch

Tap and die set

Bench vise

File

Cutting oil

Metal stock, selected by the instructor

* Everyone participating in or observing the demonstration should wear appropriate protective eyewear and any other protective clothing as needed.

NOTE: The following demonstrations are intended to illustrate threading techniques covered during the classroom discussion. The demonstrations below are of techniques presented in the lesson. If additional or different techniques were covered in class, they should be added to or substituted for those below.

Procedure:

1. Wear appropriate safety equipment.
2. Demonstrate the correct procedure for tapping a hole using the tap and die set. The activities below are set up so that the procedures can be demonstrated independently. If desired, the instructor could combine the activities by threading a rod in the second procedure that would fit the hole threaded in the first procedure.
 - a. Mark the metal using the center punch.
 - b. Secure the work and drill a hole the proper size for the bolt that will be used. The correct tap drill hole will be slightly smaller than the tap to leave enough material for the tap to cut the thread. To select a tap drill, consult a table or use the formula $DS = D - 1/N$.

- c. Drill the hole for the tap. If using a portable drill, be careful to keep the drill at a 90-degree angle to the work.
 - d. Put the tap in the wrench, place the end of the tap squarely in the hole, and apply cutting oil to the tap.
 - e. Apply even, downward pressure and turn the tap wrench clockwise about half a turn.
 - f. Turn the wrench back counterclockwise about a quarter of a turn to break the metal chip that forms as the threads are cut.
 - g. Continue advancing the wrench and turning it backward to break the chips until the tap is through the stock or the bottom of the hole is reached. Once the tap has started, downward pressure is not necessary. The tap should thread itself into the hole. Add oil as needed.
 - h. Clean oil and metal chips from the tools, parts, and work area, following all steps for correct procedure and safety.
 - i. Dispose of oily rags or paper towels in an appropriate container.
3. Demonstrate the correct procedure for threading a rod using the tap and die set.
- a. Start with a piece of round stock. The end should be at a right angle to the side. Secure the piece and chamfer the end to a 45-degree angle using a file.
 - b. Select the correct die and put it in the stock.
 - c. Add cutting oil to the tapered side of the die and the chamfered end of the stock and place the tapered side of the die on the stock.
 - d. Apply even downward pressure and turn the stock clockwise about half a turn.
 - e. Turn the wrench back counterclockwise about a quarter turn to break the metal chip.
 - f. Continue advancing the die and turning it backward to break the chips until the desired length has been threaded. Add oil as needed.
 - g. Remove the die and clean all tools, parts, and the work area.
 - h. Dispose of oily rags or paper towels in an appropriate container and demonstrate any additional cleanup procedures as needed.