



Royal Rangers

Merit Requirements: Silver-Bordered Merit

METALWORK MERIT

Note: This merit may be completed by earning at least a B for one semester of a metal shop class in high school and completing Requirements 5, 6, and 8, OR by completing all of the following requirements.

1. Define the following terms:
 - a. Metallurgy
 - b. Thickness gauge
 - c. Rockwell hardness tester
 - d. Rivet
 - e. Spot weld
 - f. Alloy
 - g. Corrosion resistance
 - h. Ferrous metals
 - i. Nonferrous metal
 - j. Tensile strength
 - k. Babbitt
2. Describe the following metals.
 - a. Low-carbon steel
 - b. High-carbon steel
 - c. Galvanized steel
 - d. Cold-rolled steel
 - e. Nickel-chromium steel
 - f. Tungsten steel
 - g. Tungsten-carbide steel
 - h. Pure iron
 - i. Cast iron
 - j. Pig iron
 - k. Wrought iron
 - l. Aluminum
 - m. Aluminum alloy
 - n. Lead
 - o. Magnesium
 - p. Nickel
 - q. Tin
 - r. Zinc
 - s. Copper
 - t. Brass
 - u. Bronze
 - v. Silver
 - w. Gold
 - x. Green gold
 - y. White gold
 - z. Pewter
 - aa. Sterling
3. List at least fifteen kinds of tools a metalworker would use.

4. Describe the following processes that a metalworker uses in his trade.
 - a. Hardening metal
 - b. Tempering metal
 - c. Draw filing
 - d. Milling
 - e. Layout
 - f. Drilling
 - g. Cutting threads
 - h. Riveting
 - i. Setting rivets
 - j. Welding
 - k. Annealing
 - l. Bending
 - m. Hemming
 - n. Etching
 - o. Shaping a part
 - p. Stamping a pattern
5. Complete the following:
 - a. Define SAE and USS threads including each classification's title for a coarse thread and a fine thread.
 - b. Explain how to identify the following:
 1. Thread size
 2. Threads per inch
 3. Thread length
 4. Bolt length
 5. Wrench size
 - c. Explain what the following thread classification means:
3/8- 16:
 - d. Use the "Tap Drill Size Chart for Standard Threads" (at the end of the merit) to determine the correct drill size needed to drill a hole for the following:
 1. 5/16-24
 2. 7/16-14
 3. 1/2-20
 - e. Create a display of the ten sizes of bolts listed below. Label each according to its size and thread classifications.
 1. 1/4-20
 2. 1/4-28
 3. 5/16-18
 4. 5/16-24
 5. 3/8-16
 6. 3/8-24
 7. 7/16-14
 8. 7/16-20
 9. 1/2-13
 10. 1/2-20
 - f. Describe two methods for determining the threads per inch of a bolt.
 - g. Describe two methods for determining the diameter of a bolt.
6. Size a piece of metal stock correctly by doing each step in order. Read all the steps before beginning.
 - a. Cut a piece of metal with a hacksaw from cold-rolled steel stock to a rough size of 4 1/4 inches long by 1 1/2 inches wide by 3/8 inch thick.
 - b. File the edges of the stock so that they are parallel to each other and the metal is 1 7/16 inches wide.
 - c. File and square up the ends of the stock so the metal's length is 4 3/16 inches.
 - d. Drill two holes of proper size and make internal threads at 1/4-28 and 3/8-16. The finished holes and threads are to be completed as follows:
 1. Layout the center of the holes 1 3/4 inches from each edge and centered on the 1 7/16 inches stock width.
 2. With a center punch, make an indentation so you can properly drill a hole with a twist drill without the drill wandering.
 3. Check the drill chart to select the proper diameter drill for drilling the hole. The finished tapped hole must have clean looking threads and threads that fit properly. Use a sharp drill for an easier time of drilling and to create a round hole that is the correct diameter.
 4. For safety's sake, the stock must be clamped into a vice before drilling the hole. If the stock is not clamped into a vice, the drill bit can catch the stock and spin it at high speed, possibly causing serious injury. It is preferable to use a drill press because it gives you more control and a better chance of creating a round hole. If a drill press is not available, use an electric hand drill, but again, be sure the stock is securely clamped in a vice.

- e. Finish the stock to the following requirements:
 1. Polish the surface of the stock. First, it should be draw-filed followed by various grades of emery cloth until the surface is polished.
 2. The edges should be square. Check with a combination square.
 3. The edges and corners should be evenly beveled on all sides to a 1/32-inch to 1/16-inch bevel.
 4. All surfaces and edges are to be polished.
 5. Find two bolts to screw into the threads. Leave them in the stock for your commander's review.
7. Complete ONE of the following projects. Use at least five of the processes mentioned in Requirement 4 for making your project.
 - a. Make a tool tray carrier out of galvanized sheet metal (thickness to be 20-gauge or thicker). Be sure that there are no sharp edges left on the finished project. All edges are to be hemmed. You may rivet (using pop rivets or standard rivets) or solder the joints. All surfaces are to be clean.
 - b. Complete an art form project made from one or more metals and/or wire.
 - c. Make a tool, such as a chisel, punch, ball-peen hammer, or a tool of your choice. The project must be completed by using the hardening and tempering processes that are required for the tool to function properly. All surfaces are to be polished.
 - d. Make a useful holder, stand, etc., that can be used in the shop or in the home. (This project needs to be preapproved by your commander.)
 - e. Make a project of your choice. (This project needs to be preapproved by your commander.)
8. Interview a metalworker and write a report of his responses to the following:
 - a. Describe the type of work a metalworker performs.
 - b. Is the work rewarding? Why or why not?
 - c. Describe the training needed to be successful in this trade.
 - d. List high school courses a student could take to prepare for this occupation.
 - e. Describe the experience or licensing needed to enter or work in this trade.
 - f. Describe the competition level for entry into this field.
 - g. Describe the advancement opportunities from an entry-level position in metalwork.