



# SCOUTS, BSA: ENGINEERING MERIT BADGE

HISTORY. ENGINEERING. DESIGN. CULTURE.



# MERIT BADGE REQUIREMENTS AND INFORMATION

**The Engineering Merit Badge requirements listed below are those required by Scouts, BSA.**

**Some of the options offered in the Merit Badge requirements are not offered through the Harley-Davidson Museum®.**

**Before coming to the Museum to complete the merit badge requirements, you must read the Engineering Merit Badge book.**

**To be eligible for an Engineering Merit Badge, you must complete all of the requirements as outlined in this book.**

**To earn the Engineering Merit Badge you must complete the following requirements:**

1. Understand the work of six different types of engineers.  
Explain how their work is related.
2. Explain what it means to be a registered Professional Engineer.
3. Explain how the Engineer's Code of Ethics is like the Scout Oath and the Scout Law.
4. Learn about three engineering careers and the education, training and experience needed to pursue that type of career.
5. Learn about the engineering of motorcycles and how the motorcycle has influenced the world today.
6. Investigate how and why a manufactured item works by viewing the videos in the Engine Room.
7. Understand that in a four stroke engine, energy is converted from a gas-fuel mixture to a power stroke.
8. Learn what engineers do at Harley-Davidson through the design and engineering of historic racing motorcycles.
9. Make an original design for a piece of Scout patrol equipment.

## Helpful Reminders:

1. Read the Engineering Merit Badge book before visiting the Museum.
2. Bring this booklet, your Blue Card and a writing utensil along with you to the Harley-Davidson Museum®.





# REQUIREMENT 1

Match the engineers below to the work that they do.

- |                             |  |
|-----------------------------|--|
| _____ Civil engineers       | 1. Develop useful things based on the newest advances in chemistry.  |
| _____ Mechanical engineers  | 2. Design food farm and food processing equipment and develop systems for irrigation, drainage, and waste disposal.                                |
| _____ Chemical engineers    | 3. Apply the principles of physics to design, build and maintain mechanical systems.   |
| _____ Bioengineers          | 4. Meet society's need for infrastructure—like roads, railways, bridges, dams, etc.  |
| _____ Computer engineers    | 5. Find ways to make memory storage devices smaller, to fit more circuits on a microchip, and to move data faster and faster through the circuits. |
| _____ Agriculture engineers | 6. Combine biology and engineering to study the mechanics of living organisms, often working with medical doctors.                                 |

Pick two different types of engineers and in the space below tell how their work is related.

---

---

---

---

---

---

---

---

# REQUIREMENT 2, 3 AND 4

Find a quiet space in the Harley-Davidson Museum® and answer the following questions.

What does it mean to be a registered Professional Engineer (P.E.)?

---

---

You have read the Engineer's Code of Ethics.  
How is this code like the Scout Oath and Scout Law?

---

---

List three different careers in engineering

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Choose one career and describe the type of education, training and experience required for this profession.

---

---

---

---

---

---

---

---

---

---

# REQUIREMENT 5

Motorcycles are an engineering achievement that has had a major impact on society. Visit the historical galleries on the upper level of the museum and answer the following questions:

What are the names of the four founding fathers that started the Harley-Davidson Motor Company?

---

---

---

---

Which founding father was the chief engineer?

---

---

Look around the historical galleries.

What were some of the challenges that the founding fathers had to overcome in the first 30 years of the Motor Company?

---

---

---

---

---

---

How has the Harley-Davidson® motorcycle influenced the world since the company began?

---

---

---

---

---

---

# REQUIREMENT 6

View the engine videos in the Engine Room on the upper level of the museum. These demonstrate how all of the parts of an engine work together. Answer the questions below.

What sort of engineering activities were needed to create the object?

---

---

---

---

---

---

---

---

In the space below, list three observations you made while viewing the engine videos.

Share what you learned with your counselor.

---

---

---

---

---

---

---

---

# REQUIREMENT 7

Visit the Engine Room on the upper level of the museum and the “How it Works” display. List the four strokes in the engine cycle and fill in the blanks.

\_\_\_\_\_ The flywheel draws the piston downward, allowing an atomized mixture of \_\_\_\_\_ and \_\_\_\_\_ into the enclosed cylinder.

\_\_\_\_\_ The intake valve closes. The piston climbs \_\_\_\_\_ and compresses the air-fuel mixture.

\_\_\_\_\_ The piston reaches the top, the spark plug fires and the compressed air-fuel mixture \_\_\_\_\_. As the mixture burns, it expands, and thrusts the piston downward again.

\_\_\_\_\_ The piston moves up the cylinder and the exhaust valve opens pushing the \_\_\_\_\_ out and the process starts all over again.



# REQUIREMENT 8

After studying some of Harley-Davidson's designs for purpose-built racing motorcycles, think about an improvement you could make to a piece of patrol equipment. Sketch your original design below. Use the systems engineering approach to help you decide how it should work and look. Explain your design. Tell what improvements you made, including the materials and measurements you used.

		PROJECT										DATE									
		DRAWN BY																			