

Practical Exercise for Instruction Pack 2

By

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About the Author

Edward Abdo has been actively involved in the motorcycle and ATV industry for over 25 years. He received factory training from Honda, Kawasaki, Suzuki, and Yamaha training schools. He has worked as a motorcycle technician, service manager, and Service/Parts department director.

After being a chief instructor for several years, Ed is now the Curriculum Development Manager for the Motorcycle Mechanics Institute in Phoenix, Arizona. He is also a contract instructor and administrator for American Honda's Motorcycle Service Education Department.

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INTRODUCTION

The purpose of this practical exercise is to help you apply your knowledge of motorcycle and ATV engine operation to some real-life examples. In this exercise, you'll become even more familiar with two-stroke and four-stroke engines and learn some things that weren't covered in the study units.

At the beginning of this practical exercise are four Suggested Activities. As in the practical exercise that you did previously, you'll have a chance to get out and have some fun while you continue to learn by applying the knowledge you've gained thus far. Note that these activities are optional and aren't required to complete the program. However, accomplishing the activities can help you gain a better understanding of the study unit material. We strongly recommend that you attempt to complete as many of the activities as possible.

If you wish to review the text material that covers the topics contained in this practical exercise, you can refer back to the following study units:

- *Four-Stroke Internal-Combustion Engines*
- *Two-Stroke Internal-Combustion Engines*

When you've finished with the suggested activities, complete the examination at the end of the exercise. The examination is required and must be submitted to the school for grading.

Remember, even though this exercise contains examination questions, we've designed it to be fun! Applying your knowledge will help you to realize just how much you've really learned about how the engines used in motorcycles and ATVs operate.

SUGGESTED ACTIVITIES

It's time again to get out and have some fun. The following pages contain some activities that relate to the two-stroke and four-stroke engines used in motorcycles and ATVs that you've been learning about. Try these activities to expand your knowledge and improve your understanding of the written material contained in the study units. Remember, none of these suggested activities are required to complete the program and none of them will be graded. These activities are simply designed to help you apply your motorcycle and ATV engine operation knowledge. At any time, you can proceed to the graded portion of the practical exercise.

Question: Which motorcycle and ATV brands and models that you've seen use the two-stroke engine design?

BRAND	MODEL

Question: Which engine design did you find to be the most popular—the two-stroke or the four-stroke engine design?

Question: Why do you suppose one engine is more widely used than the other?

Activity 2

While looking at the different motorcycles and ATVs during your visit, which types of configurations can you find using the two-stroke and four-stroke engine designs?

Use the following checklist to record your findings.

	Two-Stroke	Four-Stroke
Single	_____	_____
Vertical twin	_____	_____
V-twin	_____	_____
Opposed twin	_____	_____
Triple	_____	_____
Inline four	_____	_____
V-four	_____	_____
Inline six	_____	_____
Opposed four	_____	_____
Opposed six	_____	_____

Activity 3

Visit your local public library and look up information on the history of the motorcycle along with the two-stroke and four-stroke engines. Try to answer the following questions that pertain to the history of the motorcycle and the engines that are used in today's motorcycles and ATVs.

Which engine (the two-stroke or the four-stroke) was invented first?

In what year was the four-stroke engine invented?

Who invented the four-stroke engine?

In what year was the two-stroke engine invented?

Who invented the two-stroke engine?

Who built the first motorcycle?

Which company built the first American-made motorcycle?

Which Japanese company first started selling motorcycles in the United States?

What type of engine was used in the first motorcycle ever produced?

What type of engines did the first motorcycles use, air-cooled or liquid-cooled?

Activity 4

The next time you take a ride on a motorcycle or ATV, listen carefully to the engine. As you listen, try to imagine all of the stages of engine operation as they're occurring inside the engine. Do this for both a four-stroke engine and a two-stroke engine.

Four-Stroke Engine

Visualize the piston attached to the connecting rod and crankshaft as it moves up and down in the cylinder. Think of the camshaft as it operates the intake and exhaust valves. When the intake valve is opened, the air-and-fuel mixture is drawn into the cylinder as the piston moves toward BDC. As the piston returns toward TDC, the intake valve closes and the air-and-fuel mixture is compressed in the combustion chamber under the spark plug. When the spark plug fires, the piston is forced back down in the cylinder, producing the power stroke. As the piston again returns toward TDC, the camshaft opens the exhaust valve and the exhaust gases are forced from the cylinder. When the piston reaches TDC, the intake valve opens, the exhaust valve closes, and the cycle repeats itself.

Two-Stroke Engine

Visualize the piston attached to the connecting rod and crankshaft as it moves up and down in the cylinder. Picture the ports in the cylinder wall being covered (closed) and uncovered (opened) as the piston moves up and down. When the piston moves up towards TDC, it creates low pressure in the crankcase primary area to draw in fresh air-and-fuel mixture. At the same time as the air and fuel is entering the

crankcase, think about the compression that's occurring in the secondary area above the piston in the combustion chamber. As the piston reaches TDC, the spark plug ignites the mixture. The piston is forced back down in the cylinder by the expanding gases. As the exhaust port is uncovered, the exhaust gases are forced through the exhaust port into the exhaust system expansion chamber. Remember how the expansion chamber is tuned, which allows the pressures developed in the chamber to increase engine efficiency. Also, while the piston is moving downward, remember how the air-and-fuel mixture is forced from the crankcase area through the transfer port into the area above the piston to help remove exhaust gases and get ready for the next intake and compression cycle.

Engine Speed

The purpose of this activity is to give you an appreciation of how fast the components in an internal-combustion engine are moving. If you look at the tachometer found on most motorcycles, you'll find that engine speeds upward of 10,000 rpm are common. The piston must move up and down for each revolution of the crankshaft. [Table A-1](#) shows how many piston strokes occur each second at various engine speeds. To calculate this number yourself, divide the engine speed (rpm) by 60 (number of seconds in one minute) and multiply by 2 (piston strokes per crankshaft revolution). The number of complete engine cycles per second can then be determined by dividing the piston strokes by 2 for a two-stroke engine or by 4 for a four-stroke engine. Remember, because there's one power stroke for each complete engine cycle, that the number of cycles that are completed each second is also the number of power strokes per second.

Table A-1

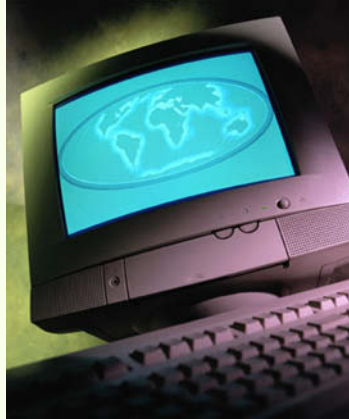
TWO-STROKE AND FOUR-STROKE ENGINE SPEEDS

ENGINE SPEED (rpm)	PISTON STROKES PER SECOND	CYCLES PER SECOND (TWO-STROKE)	CYCLES PER SECOND (FOUR-STROKE)
500	16.67	8.33	4.17
1000	33.33	16.67	8.33
2500	83.33	41.67	20.83
5000	166.67	83.33	41.67
7500	250	125	62.50
10,000	333.33	166.67	83.33
12,500	416.67	208.33	104.17

Pretty amazing isn't it? To think that an engine goes through each of the stages of engine operation so many times and so quickly.

CONCLUSION

We hope you've enjoyed the practical exercises. When you're ready, proceed to the graded portion of the practical exercise. This part of the exercise is completed in the same way as the other examinations for your program. Follow the instructions provided to send your answers in to the school for grading.



ONLINE EXAMINATION

For the online exam, you must use this

EXAMINATION NUMBER:

03382300

When you're confident that you've mastered the material in your studies, you can complete your examination online. Follow these instructions:

1. Write down the eight-digit examination number shown in the box above.
2. Click the **Back** button on your browser.
3. Click the **Take an Exam** button near the top of the screen.
4. Type in the eight-digit examination number.