

What students will learn

When they have finished the Fuel module, students should be able to:

- Choose the right fuel for their engine
- mix the right petrol and oil for a 2-stroke engine
- know the main parts of a fuel system
- check fuel tanks, lines and primers
- check and replace fuel filters
- know about safety with fuel

Things you need before you start

Information

You will need ideas and information on:

What type petrol is available locally – and where from

What 2-stroke oil is available

What fuel/oil ration mix is used for the engines your students will work on?

Materials

Examples to show students:

2- and 4-stroke fuel engines – outboard motors

Attached and separate fuel tanks

Fuel lines and primers

Fuel filters – tank, in-line and carburettor

Petrol, 2-stroke oil and measuring/mixing containers

Tools or equipment

If students don't have their own engines, you may need to provide suitable engines to work on

Students will need tools and equipment to check, clean and change filters:

Fuel - Activity

The activities in this module require the students to collect fuel information about the engines they are working on.

The students then carry out the regular maintenance checks on the fuel system and then check, clean – or replace- the fuel filters.

Ideally, students should use their own engines for this activity. It would be useful for them to carry out the maintenance tasks on other types of engine and equipment as well.

Students should work together in small groups to answer the questions and carry out the fuel maintenance tasks.

The module

The workbook sections for this module are:

Types of fuel

Petrol

Petrol mix

Fuel filters

Carburettor

Fuel tanks and lines

Maintenance

Cleaning and changing filters

Regular checks

Copies of the workbook sections are included in your manual here as well as in the Student Workbook.

You need to work through each section with the students, talking about the fuels, the parts and showing the students what to do – and what they should NOT do.

Remember

The workbooks are **not** designed to be used by the students learning on their own.

General fuel introduction

Use these notes for an introduction at the beginning of the Fuel module.

To start the module, talk to the students generally about the main things they will learn and what they will do in each section:

- types of fuel, and what they need for their engines
- safety and special things they should know about fuel
- the fuel equipment – tanks, lines, filters
- safety and maintenance checks.

Explain

Explain that in the module:

- You will talk about each of these things – and show them what and how to work on the engines.
- They will collect information about THEIR engine, and
- Finally, they will get to carry out checks, change/clean filters etc.

Then move into *Types of fuel*.

In addition:

Talk about - the need for advice and assistance

It is **very** important that students understand the limits of what they learn on this course. Here they learn only about simple, small – scale checks and maintenance jobs such as filters and fuel checks.

Bigger jobs **need expert knowledge and skill and equipment** to dismantle, repair and adjust.

Make sure students understand that they need expert assistance for any larger or safety related work.

Types of fuel

In this section, students:

- learn about different fuels
- identify the fuel they need for their engine
- mix 2-stroke fuel correctly

Work with students through each part of the workbook notes.

Talk about - petrol

- Talk about your local petrol.

Where it comes from and where it is stored

What grades and octane ratings do you have?

Where do students buy it from – and how do THEY store it?

- Talk about the most suitable grades for the students' engines.

Talk about - Safety

- Reinforce the importance of safety when storing, filling tanks or working with petrol parts.
- Make sure the students understand the need for:
 - No naked flames, cigarettes or electrical equipment
 - Open air flow for storing and working on fuel

Talk about - petrol and oil mix

- Why 2-strokes have oil mixed with petrol.
- The right type of 2-stroke oil for the job.
 - TCW3 for outboards
 - Proper 2-stroke oil for others
 - NEVER engine oil!

- The right ratio of oil and petrol. Explain the ratio chart and quantities on the worksheet.

Help students find what ratio their engine needs – and what this means in actual quantities (use the chart again).

Explain

- Some new 2-stroke outboard engines do not use a fuel/oil mix in the tank. They have a separate oil tank and pipe to the engine where the petrol and oil are mixed as they go into the engine.

Show

the right way to mix 2-stroke fuel.

Get them to show you that they can measure out the right quantities and then mix the fuel correctly.

Talk about – important things about your fuel

- Make sure students understand that fuel must be **clean, free of water** and be **fresh**.

Explain what fuel *jets* are. They are tiny holes of an exact size to let the right amount of fuel flow through.

- Talk with them about things they can do to keep their fuel this way.

Fuel filters - notes

In this section, students:

- Learn about what filters do
- Locate the filters on their engine

Work with students through each part of the workbook notes.

You may like to use some of the pictures and explanations of different filters that are on the **Fuel – Maintenance** worksheet

Talk about

- The purpose of fuel filters – to catch dirt and debris in the fuel before it can clog or block fuel lines and the jets in the carburettor

Coarse filters will let water through to the carburettor where it will need to be drained out

Very fine filters will stop the water – but this will then block the filter as well. Clean or change it to get the engine started

- Where filters are located – in the tank, in the fuel line, at carb inlet etc

Show Where the filters are located on one or two engines.

- How to tell if a filter needs to be replaced.
- Examples of different filters and how to clean or replace them.

Talk about

- How to find out what model/part number of replaceable filter the student needs
 - and where they can get them from
- How to check for leaks after cleaning/replacing filters

Student activity

Help students with the activity

They check, clean/replace fuel filters on their engine and check for leaks.

Carburettor - notes

In this section, students:

- Learn about what a carburettor does
- Learn about how it works – basically
- Learn about simple adjustments – and when to stop!

Work with students through each part of the workbook notes.

In addition:

Talk about – knowing when to stop!

- Carburettors are complicated and need to be set-up exactly before an engine will start and run correctly, give full power and use least fuel.
- Make sure students understand that they should not fiddle, adjust or dismantle any parts of a carb unless they know what they are doing – or have expert help.
- Most new car engines have a system to inject (spray) petrol directly into the engine cylinders. Larger outboard motors and many motorcycles also have **fuel injection systems** – but they need complicated electrical systems and electronics to make them work properly.

Show

- Where the carburettor is located on 1 or 2 engines.
- An actual carburettor if have one available – removed from an engine

Talk about – How carburettors work?

- Explain the diagrams on the worksheet.
- Real carburettors on engines have many more complicated bits to control the amount of fuel under all conditions.

Show

Adjustments

- For two different engines you have makers books for, show how to adjust the idle speed and slow running jets

Help

Students to make idle speed and slow running adjustments on their own engines.

The workbook advises students NOT to adjust engines unless they have instructions from someone who can help. Show them what adjustments they can safely make on their own engines.

Talk about - clearing the fuel bowl

- Some carburetors on small engines have a drain Plug or Screw at the bottom of the fuel bowl. This lets you drain out old, stale fuel or any water or dust in the fuel that has collected in the bowl. The engine manufacturers Manual should show this.
- If this plug is fitted to students' engines, show them how to remove the plug and drain the bowl.

Fuel Tanks - notes

In this section, students:

- Learn about types of fuel tanks

Work with students through each part of the workbook notes.

In addition:

Talk about – Safety

- Make sure students understand the need for care:
 - when filling tanks
 - to have filler caps in good condition
 - in checking for damage and leaks
- Always check they have enough fuel for the journey – and a safety margin!

Show

A fixed tank on an engine and on/off taps – and examples of separate tanks and their fittings for an outboard motor.

Fuel lines and pumps - notes

In this section, students:

- Learn about fuel lines
- Learn about primer pumps
- Check condition

Work with students through each part of the workbook notes

Talk about – fuel lines

Different type of fuel lines –

- fixed and quickly detachable connections to tanks,
- single and dual lines
- plastic/rubber and metal
- fittings and connections

Show

The fuel lines and connections on 1 or 2 engines/boats.

How to check for damage, leaks

Talk about – primers

- In-line primer hand primer pumps – what they do, and how to use them.
- Primer bulbs on carburettors, for cold starting – what they do and how to use them.

Help

Students to check fuel lines and primer pumps on there own engines/boats.

How to check for damage, leaks

Talk about – outboard motor emergency

- If an outboard motor fuel pump, filter or line fails when out at sea, it may be possible to fix up a direct gravity-feed of fuel from the tank. Talk about how the student could do this with their own engine in an emergency.