

O3 Protégelo— Full Installation & User Manual

Revision: Rev-Final - Language: English -Scope: Usage / Installation / Diagnostics only

Governing document: Definitions & Conventions — Rev-Final

This document must be used together with the O3 Protégelo *Definitions and Conventions* document, which governs terminology, installation rules, and diagnostic principles.

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1. Purpose of the Device

The O₃ Protégelo device is an external, passive, non-electronic unit installed on a fuel line.

The device interacts with the fuel prior to combustion within the engine.

The device:

- Has no moving parts
- Requires no electrical connection
- Does not interface with engine control units
- Requires no calibration or software interaction

1.1 Technical Operating Principles (Informational)

The O₃ Protégelo device is a passive unit installed in the fuel supply line.

1 — Device interaction

During operation, trace ferric oxide particles are generated within the fuel stream through interaction between the fuel and internal materials of the device.

2 — Fuel system behaviour

The device does not create a restriction in the fuel system and does not alter fuel pressure, pump operation, injector control, or engine management parameters.

3 — Combustion behaviour

These particles circulate with the fuel through the injection system and into the combustion chamber, where they may participate in oxidation reactions during hydrocarbon combustion.

- Ferric oxide is known to participate in oxidation reactions during hydrocarbon combustion. Under combustion conditions, these particles may influence the oxidation behaviour of hydrocarbon fuel components and intermediate combustion products.
- The resulting combustion environment may therefore exhibit changes in the formation behaviour of incomplete combustion products such as hydrocarbons (HC), carbon monoxide (CO), and soot.
- The device does not modify injection timing, fuel pressure, or engine control parameters. Its function is limited to influencing the chemical environment of the fuel prior to and during combustion.
- No external energy source, electronics, or software interface is required.

2. Compatible Fuels and Applications

2.1 Fuels

The device is intended for use with room-temperature liquid hydrocarbons, including but not limited to:

- Diesel
- Petrol (gasoline)
- Fuel oil

2.2 Applications

Typical applications include:

- Road vehicles (diesel and petrol)
- Non-road mobile machinery (construction, mining, ports, etc.)
- Marine engines
- Generator sets
- Combustion burners using room-temperature liquid hydrocarbon fuels, where a feed fuel line is present

3. Product Families and Service Life

3.1 Product families

O₃ Pro / O₃ Pro Duo

Reusable units fitted with a replaceable internal cartridge

O₃ Van / O₃ Car

Sealed, non-reusable units

3.2 Service life (all models)

All O₃ models have an operational service life of approximately 2.5 years from first contact with fuel.

At end of service life:

- Cartridge-based models: replace the cartridge
- Non-reusable models: replace the unit
- *At the end of the service life, the device no longer influences fuel behaviour.*
- *Engine combustion characteristics and operational behaviour will gradually return to levels experienced prior to installation.*

4. Safety Information

4. Safety Information

Installation must be carried out by a competent technician familiar with fuel systems.

Before installation:



- Ensure the engine is switched OFF and the ignition key removed
- Isolate and depressurise the fuel system according to OEM procedures
- Allow the engine and fuel system to cool where possible

Fuel circulating in an operating engine may reach elevated temperatures. Allow the engine and fuel system to cool before performing installation or service.

During installation:

- Work in a well-ventilated area
- Keep sparks, open flames, and other ignition sources away from the work area
- Wear appropriate personal protective equipment when working with fuel systems

The device does not modify engine control systems and does not alter safety systems.

5. Installation Location, Line Selection, and Orientation

5.1 Orientation

The device may be installed in any physical orientation.

There is no required flow direction.

For larger engines or higher fuel flow applications, a **vertical installation orientation is preferred where practicable**, with fuel flowing bottom-to-top.

This orientation promotes natural migration and release of entrained air during operation and reduces the likelihood of localised air accumulation under sustained higher flow conditions.

Where vertical installation is not possible due to space or layout constraints, horizontal installation remains acceptable, provided correct bleeding is performed and hydraulic integrity is confirmed.

Installer note:

Installation orientation does not affect the catalytic function of the device.

This guidance relates solely to air behaviour in higher fuel flow systems.

5.2 Installation line selection

The feed fuel line is the standard and recommended installation location.

This applies to:

- Road vehicles
- Non-road mobile machinery
- Marine engines
- Generator sets

The device may be installed on the return fuel line only where access to the feed line is not practical and for normal operational use.

Operational monitoring, such as observing engine behaviour, telematics trends, or general fuel consumption over time, may be carried out with the device installed on the return line.

For any formal, controlled, or comparative measurement (including emissions testing, structured fuel consumption testing, or A/B comparison trials), the device must be installed on the feed line.

Note:

Combustion burners do not have a return fuel line. Installation on combustion burners is therefore always on the feed line.

-Installation location must comply with the equipment manufacturer’s service instructions and warranty conditions.

The installer is responsible for selecting a location and connection method that does not conflict with OEM maintenance or warranty policies.

-Where **modification of the feed fuel line is restricted or discouraged** by the equipment manufacturer, installation on the return line or another accessible section of the fuel circuit may be used.

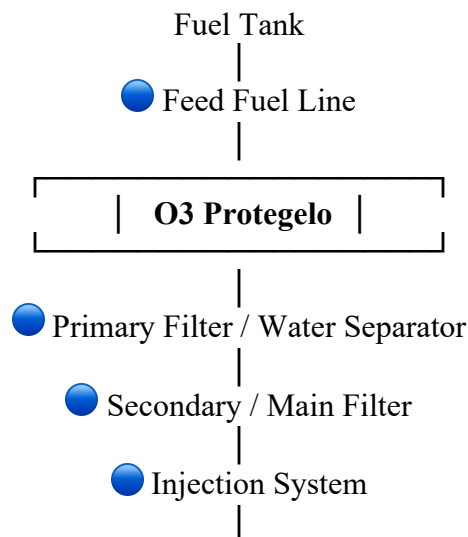
5.3 Typical Installation Configurations (Examples)

The diagrams below illustrate common installation locations.

The final installation position should be selected according to system layout, accessibility, fuel cleanliness, and OEM service policies.

Option 1 — Upstream of Primary Filtration

Diagram:



Legend

- Feed fuel line
- Return fuel line

Option 1 — Upstream installation

Installed before the primary filtration stage.

Often used where access near the tank or supply line is easiest.

Important condition

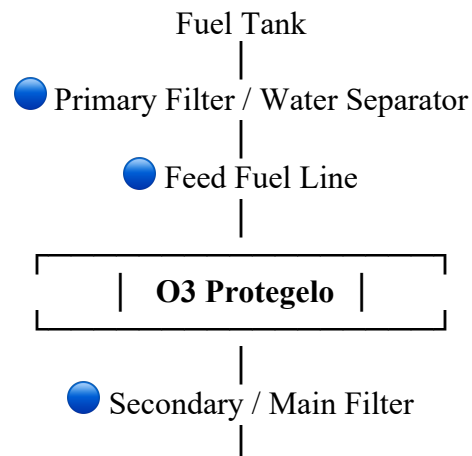
This configuration should only be used where **fuel cleanliness is well controlled and the fuel system is known to be free from contamination such as water, sludge, microbial growth, or particulate matter.**

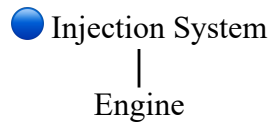
Where **fuel cleanliness is uncertain**, installation downstream of the primary filtration stage (Options 2 or 3) is preferred.

Option 2 — Between Water Separator and Main Filter



Configuration: Installed **between the primary water separator and the secondary/main fuel filter.**

Diagram layout





Legend

-  Feed fuel line
-  Return fuel line

Option 2 — Mid-system installation

Installed between filtration stages.

Typical situations where this option is used

- Engines with **two-stage filtration systems**
 - Generators, marine engines, heavy equipment**
 - Installations where the space between filters is **easy to access**
-

This configuration allows the device to operate with fuel that has already passed through the primary filtration stage.

This option is often the **most practical location** because:

- fuel has already passed the **water separator**
- installation is often **physically accessible**
- it avoids modifying the **line near the injection system**

Option 3 — Downstream of Filtration (Near Engine)

Configuration: Installed **after the final fuel filter and upstream of the injection system.**

Diagram layout

Fuel Tank



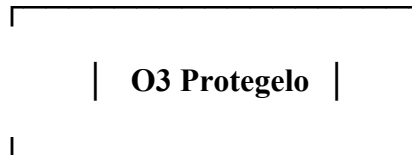
● Primary Filter / Water Separator



● Secondary / Main Filter



● Feed Fuel Line



● Injection System



Engine

Legend

- Feed fuel line
- Return fuel line

Option 3 — Downstream installation

Installed after the final filtration stage and before the engine fuel injection system.

Typical situations where this option is used

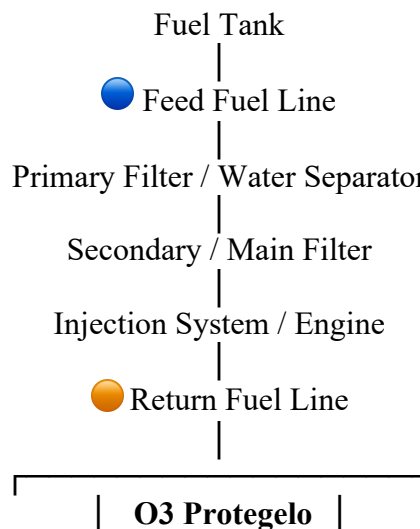
- Access to the **fuel line near the engine is easiest**
- Fuel system layout places filters **close to the engine**
- Installers prefer installation **after filtration**

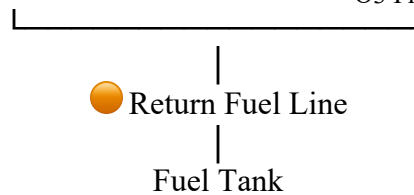
In this configuration the fuel has already passed through the filtration system before entering the device

Option 4 — Return Line Installation



Configuration: Installed on the **return fuel line** back to the tank.

Diagram layout





legend

-  Feed fuel line
-  Return fuel line

Option 4 — Return line installation

Installed on the return fuel line where access to the feed fuel line is difficult or where customers prefer to avoid modification of the feed circuit.

Important note

Return-line installation is acceptable for normal operational use and observation of engine behaviour.

For formal comparative testing, installation on the feed fuel line is preferred.

6. Tools, Fittings, and Torque Requirements

6.1 Tools

- Clean cutting tool suitable for the fuel line type
- Correct fittings or adaptors for the fuel line
- Torque tool appropriate to the fitting type
- Hose clamps or supports where applicable

6.2 Fittings and connector selection

Important: Correct fitting selection and tight fit are essential. Correct fitting selection must be verified for both sides of

Some modern engines use OEM **quick-connect fuel lines**, moulded plastic fuel pipes, or integrated fuel modules.

These components may require manufacturer-approved adaptor fittings or service connectors rather than cutting the original line directly.

Before modifying any fuel line, confirm the correct procedure in the equipment manufacturer's service documentation.

Where necessary, use appropriate adaptor fittings to maintain system integrity

Do not cut or modify OEM fuel lines that incorporate sensors, heaters, or integrated connectors..

A) Vehicle / engine side (pipe or hose)

Identify line type (rubber hose, semi-rigid plastic, OEM rigid line)

Measure correctly:

- Hose: internal diameter (ID)
- Plastic or rigid line: outside diameter (OD)

Select connectors compatible with the line specification

Confirm full seating and correct insertion depth

Ensure no looseness, rocking, or partial engagement

B) Device side

Confirm correct fitting or adaptor for the device port

Ensure correct thread type and sealing method

Do not force mismatched fittings

C) General requirements

Pipe side and device side must be sized independently

Avoid side-load or tension at the device ports

Provide adequate support to prevent vibration loading

Push-in connectors are single-use only

6.3 Torque requirements

22 Nm — brass or chromed-brass fittings

20 Nm — plastic fittings

!!! Hand-tightening is not acceptable !!!

7. Installation Procedure

1. Confirm installation line (feed or return)
2. Isolate and depressurise the fuel system
3. Clean and cut the fuel line squarely
4. Inspect cut ends for damage or deformation
5. Prepare fittings and confirm correct sizing
6. Mount the device securely, protected from heat and movement
7. Connect fuel lines, ensuring full seating
8. Torque all fittings to specification
9. Support fuel lines to prevent vibration or strain

Installation must be performed in accordance with this document and the equipment manufacturer's procedures.

Incorrect installation may lead to fuel leakage, air ingress, or improper system operation.

8. Bleeding and Commissioning

1. Use OEM bleed or prime function if available
2. Cycle ignition ON then OFF three times (where applicable)
3. Start the engine and hold a moderate-to-high stable RPM for approximately 3 minutes
4. Allow the engine to idle for approximately 5 minutes
5. Inspect for leaks and abnormal behaviour
6. Repeat the cycle once if air is suspected

Confirm installation orientation and ensure effective bleeding, particularly where horizontal installation is used on higher fuel flow systems

9. Operational Notes After Installation

- Evaluation should be based on operation under comparable duty conditions
- Immediate post-installation impressions are not a valid basis for assessment
- Where duty cycles vary, comparisons must be made under similar conditions
- ECU, OBD, or telematics parameters may not change immediately and may reflect multiple interacting variables.
- Observations should focus on trends, not isolated readings.

10. Fuel Quality and Additives

- The device does not require fuel additives to operate.
- If additives (detergents, biocides, DPF-related additives) are already in use, they may continue to be used unless otherwise specified by the fuel or additive supplier.
- Fuel contamination may cause progressive fuel filter loading.
- Fuel filter condition should be monitored.

11. System Condition

The device does not repair or compensate for:

- Mechanical wear
- Fuel system faults
- Injection system defects
- Aftertreatment failures

If the system is *already degraded*, existing issues may become more apparent after installation.

Correct operation of the engine and fuel system remains the responsibility of the equipment owner or operator.

Installation of the O3 Protégelo device does not replace normal maintenance, inspection, or diagnostic procedures required by the equipment manufacturer.

12. Troubleshooting Overview

Refer to the Installation Troubleshooting Notes for detailed diagnostics.

Key principles:

- Early symptoms often relate to fittings or air ingress
- Delayed symptoms often relate to fuel filter loading or contamination
- Always check fuel filter condition when fuel-supply-related symptoms occur

13. Magnet Exposure

Exposure to strong external magnetic fields may magnetise components of the fuel system, including fuel lines, fittings, filters, or the device itself.

Magnetisation may occur anywhere along the fuel system, not only at the device location.

If Device becomes magnetised, the device must be replaced.

If magnet exposure is suspected:

Verification may be carried out using a magnetometer or Gauss-measurement application using a smartphone

A magnetised device must be replaced

Avoid storing or installing the device near strong permanent magnets or magnetised tools.

14. Removal and Reinstatement

The device may be removed at any time

Fuel lines may be reinstated to their original configuration

No permanent modification to the fuel system is required



15. Disposal

Dispose of the device or cartridge in accordance with local regulations for metal and industrial components.

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