

**CM  
SERIES**

**Automotive Diesel Engine – CM12**

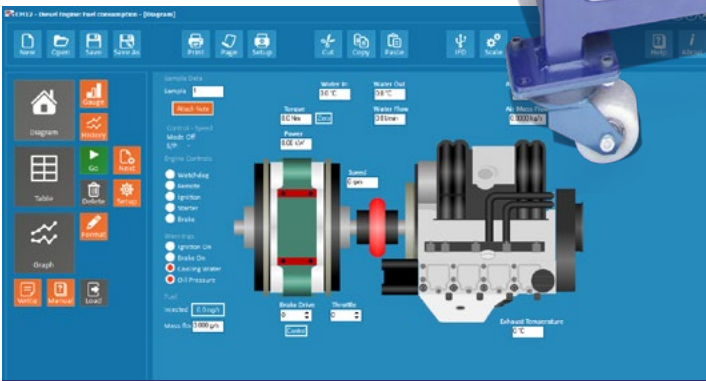
The Armfield CM12 is a self-contained diesel engine test rig, which enables students to investigate typical engine performance parameters.

The unit is designed to be linked to a computer and is supplied both with educational data acquisition and control software, as well as the engine manufacturers diagnostic software for monitoring the status of the Engine Control Unit (ECU).

**BIO DIESEL COMPATIBLE  
THIS ENGINE IS A MODERN DESIGN  
ELECTRONIC ENGINE MANAGEMENT OF FUEL INJECTION SETTINGS**



CM12- Sensors and diagnostics



Typical CM12 mimic diagram showing fuel consumption



4-cylinder engine, as used in a number of VW cars

**Features / benefits**

- ▶ 4-cylinder automotive engine
- ▶ Biodiesel compatible
- ▶ Plotting of characteristic torque and power curves against engine speed
- ▶ Full software control of system, including load and throttle settings
- ▶ Closed loop software control of brake loading to maintain constant engine speed during measurements
- ▶ Eddy current dynamometer to vary engine load
- ▶ Secondary water cooling by heat exchanger, with measurement of temperature change and flow rate
- ▶ Engine manufacturer's diagnostic software (displays fuel injection characteristics)
- ▶ Remote emergency stop and facility for safety interlocks
- ▶ Optional measurement of cylinder pressure and displaying this on a p-V diagram

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URL: <http://www.armfield.co.uk/cm12>

Applications  
**ME IP**

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## Description

CM12 is a self-contained integrated multi-cylinder engine, dynamometer and instrumentation system. It is based on a 1.9 litre, 4-cylinder automotive diesel engine as used in Volkswagen cars.

The Armfield CM12 can be run on a wide variety of biodiesel fuels and can be used for fuel testing and comparison exercises. (After each run on non-standard fuel, the engine should be run for a short time on a standard diesel fuel approved to EN590).

An eddy current dynamometer provides a variable load on the engine, enabling the characteristic power and torque curves to be reproduced in the laboratory. The system comes complete with extensive instrumentation, including rpm measurement, torque (from which power can be calculated), plus various temperatures, pressures and flows (see Technical Specification).

The whole system is designed to be linked to a computer using the software provided. This provides real time monitoring of the various sensors, with a wide range of data logging and graphical display options.

The dynamometer and throttle can both be controlled electronically from the software, which makes installation into a closed test cell very straightforward and enables remote computer operation.

A safety "watchdog" facility ensures the system shuts down safely in the event of computer failure or software lock-up.

A further advantage of the computer control is that stable rpm readings can be easily achieved using the closed loop control function on the dynamometer drive.

A closed loop primary water-cooling system is incorporated, complete with a heat exchanger for connecting into a secondary cold water supply.

## Technical specifications

### Engine Data

Engine Model	Volkswagen SDI
Displacement	1896cc
Bore	79.5 mm
Stroke	95.5 mm
Cylinders	4
Nominal Power	44 kW @ 3600 rpm
Nominal Torque	130 Nm @ 2200 rpm

### Brake

Max power	60kW
Max torque	145Nm

### Dynamometer data

Dynamometer Type	Eddy current
Cooling	Air cooled
Max Power	55kW for 20 minutes

### Instrumentation and sensors

Engine speed counter
Load cell to measure torque
Inlet air flow measured by orifice plate
Inlet air temperature
Secondary cooling water flow and temperatures (inlet and outlet)
<i>The VW diagnostic software can also be used to monitor a wide range of engine functions. In particular the injection characteristics can be used to establish the fuel consumption rate.</i>

### Overall dimensions

Length	1.20m (without castors)
Width	1.5m
Height	0.92m

### Packed and crated shipping specifications

Volume	3.20m <sup>3</sup>
Gross weight	550Kg

## Requirements

## Scale



**Electricity:** 220-240V, single phase, 10 Amps

**Cooling water:** 6 l/min at 3 bar pressure, <20°C

The user must have a PC running Windows 7 or above, with 2 free USB ports, one to run the Armfield Data logging and one to run the ECU Software

## Experimental content

- ▶ Produce a set of performance curves for the engine under varying loads
- ▶ To determine the volumetric efficiency of the engine under varying loads
- ▶ To measure the pressure inside the cylinder during a complete cycle, and to relate this to the position of the piston, producing a Pressure-Volume diagram. (Requires CM12-12 Engine Indicator Set)
- ▶ To measure the fuel consumption of the engine

## Options

### CM12-12 Engine Indicator Set

The engine indicator set comprises a high temperature pressure sensor installed into one of the cylinders in place of the glow plug.

A separate charge amplifier provides signal conditioning to generate a voltage, which can be logged on the computer. A special routine in the software enables the high speed data acquisition of this signal and automatically plots the results on a p-V diagram.

## Ordering specification

- ▶ A 4-cylinder, 1.9 litre, water cooled, biodiesel compatible Volkswagen diesel engine, complete with services and ancillaries required to run the engine in a laboratory environment
- ▶ Variable load eddy current dynamometer, which acts as a brake, enabling direct measurement of engine torque
- ▶ Supported on strong steel framework via flexible mounts. The frame also houses the fuel tank, battery and electrical enclosures
- ▶ Protected by guards around the moving parts
- ▶ Safety interlocks and emergency stops are provided
- ▶ Supplied with educational software for data logging and control
- ▶ Supplied with the engine manufacturer's diagnostic software
- ▶ Starter, throttle and dynamometer can be controlled from the users computer
- ▶ Standard instrumentation includes sensors for:
  - Engine speed
  - Torque
  - Air flow
  - Cooling water temperature (inlet and outlet of heat exchanger)
  - Cooling water flow
- ▶ Optional engine indicator set for measuring cylinder pressure through the cycle

## The CM range of equipment

CM11-MKII:	Gasoline Engine	<b>BIOFUEL COMPATIBLE</b>
CM12:	Automotive Diesel Engine	<b>BIODIESEL COMPATIBLE</b>
CM14:	Axial Flow Gas Turbine	

Armfield standard warranty applies with this product

## Knowledge base

- > 28 years expertise in research & development technology
- > 50 years providing engaging engineering teaching equipment

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## Aftercare

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