



CPA 1

Combustion Performance Gas Analysis

The CPA1 assessment has been introduced to enable gas operatives to fully comply with the requirements of BS 7967

Parts 2 to 4. - Carbon Monoxide in dwellings and the combustion performance of gas-fired appliances.

BS 7967 is divided into four parts:-

Part 1 is a guide for identifying and managing sources of fumes, smells, spillage/leakage of combustion products and carbon monoxide detector activation

Part 2 is a guide for using electronic portable combustion gas analysers in the measurement of carbon monoxide and the determination of combustion performance

Part 3 is a guide for responding to measurements
obtained from electronic portable combustion gas
analysers

Part 4 is a guide for using electronic portable combustion gas analysers as part of the process of servicing and maintenance of gas-fired appliances

**Part 1 may be useful in
assessing correct actions
when higher than normal CO
levels are found during
performance testing**

Priorities of actions are –

Protect life

Protect property

Locate all fuel burning appliances

Locate escapes of gas, fumes, smells or spillage

Confirm correct installation and safe operation

Advise of any remedial action needed

Should CO levels exceed

30 ppm

VENTILATE and EVACUATE

**Do not re-enter until the CO
level has fallen to**

10 ppm or below

Combustion Analysers



Using an analyser – assembly, inspection and suitability of the analyser

Using an analyser to determine CO levels and CO₂ levels in dwellings (Not assessed in CPA1)

Using an analyser to determine CO and CO₂ levels in combustion products from :-

Type A appliances

Type B appliances

Type C appliances

and any appliance provided with a purpose designed sampling point or specific sampling instruction

Combustion Gas Analysers

An electronic measuring instrument and therefore should be treated with care. It should be used and maintained in accordance with the manufacturer's instructions. The user must read the operator manuals and:-

- 1. ensure that batteries are correctly inserted, charged and not leaking**
- 2. ensure that the instrument is certified as being calibrated**
- 3. ensure that the display is functioning correctly**
- 4. ensure that the analyser is zeroed and purged**
- 5. ensure that the pump is working**
- 6. ensure that filters and water traps are clean and dry**
- 7. ensure that the probe tubing is free from leaks or damage**

Analysers must only be used by a person who is:-

Competent

Has an understanding of the results obtained

**Has an awareness of the necessary safety actions and regulations
(GS(I&U)R and the Gas Industry Unsafe Situations Procedure**

**The analyser must conform to the requirements of BS7860 or BS EN 50379
– CO detectors or alarms conforming to these standards are unsuitable
for use in combustion products and atmosphere analysis.**

Checking the combustion performance (CO/CO₂ ratio) of an appliance

The analyser should be assembled, checked and turned on in accordance with the manufacturer's instructions.

If the appliance is provided with a sampling point and a sampling procedure is detailed in appliance manufacturer's instructions then the combustion checks should be carried out in accordance with these instructions.

The CO/CO₂ ratio should be recorded when the appliance has been operating at maximum for 30 minutes or the reading is steady or satisfactory and is decreasing, whichever is the least time unless stated differently in the manufacturer's instructions.

New components used on gas appliances may contain or be protected by volatile compounds which could affect the combustion readings. The appliance should be allowed to burn off these substances before any test is undertaken. Should new components be fitted the same procedure should be applied.

If a new component is fitted, the appliance should be operated at full rate and a combustion reading taken after 10 mins. If the reading is unacceptable or still rising, continue sampling at 20 min intervals until a satisfactory stable level is reached or the level stabilizes at an unacceptable level. If the level does not fall to acceptable within 20 min an inspection of the appliance should be made to establish the reasons for high readings.

If no specific combustion testing guidance is available, the checks should be carried out as follows:-

Open flued appliances should be sampled with the probe tip at least 200mm into the secondary flue. *Should the open-ended probe provided prove unsuitable, a longer, open-ended probe may be manufactured from 6mm OD malleable metallic tubing approximately 500mm in length.*

Boilers and circulators (with downdraught diverter)

Open-ended probe to be positioned in the combustion products stream of the secondary flue via the downdraught diverter. A multi-hole probe as in figure 1 may be used. The probe position should be adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

Boilers and circulators (without downdraught diverter)

Open-ended probe to be positioned within the combustion products outlet duct and the probe position adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

Warm air heaters

Open-ended probe to be positioned in the combustion products stream of the secondary flue via the down-draught diverter. A multi-hole angled probe as in Figure 1 may be used. The probe position should be adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

Gas fires

Sampling probe as in figure 1 may be used where practicable, if not an open-ended probe may be used. The probe should be positioned at least 200mm up inside the flue in the combustion products stream and as far away from the burning gas as practicable. The probe position should be adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

If the probe cannot be positioned without removing the fire, then the test should not be carried out.

Combined fire and back-boilers

Open-ended probe to be positioned into the combustion products stream of the secondary flue via the downdraught diverter. Samples should be taken individually for the fire, the back-boiler and for the combined appliance.

Access to the downdraught diverter may involve the removal of the fire outer case or the fire. If the probe position cannot be maintained with the fire and case refitted or the probe cannot be inserted, the test cannot be carried out.

Room-sealed appliances

Room-sealed appliances should be sampled with the probe tip at least 200mm into the combustion products outlet duct. Care should be taken not to damage the fan assembly with the probe tip.

Appliances fitted to SE-ducts or U-ducts should not be tested as the combustion air will contain products of combustion rendering the test unreliable.

Appliances sited where access to the flue outlet is not possible and a combustion product sampling point is not fitted may not be tested.

Flueless appliances should be sampled with the probe tip, or all holes of a multi-hole probe within the combustion products stream.

Cookers

Grill – Use a probe to the design in fig.2. Position the probe in the combustion products stream, if the appliance design allows.

Should the appliance design not allow the use of a fixed probe, a probe to the design in fig.1 may be used, the probe position should be adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

The grill pan should be in the highest position for the duration of the test.

Oven - Use a probe to the design in fig.1. Position the probe in the combustion products stream, if the appliance design allows.

An open-ended probe may be used if the appliance design prohibits the use of a multi-hole probe.

Whichever probe is considered, its position should be adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

Griddles and covered burners

An open-ended sampling probe to be positioned within the combustion products stream and the probe position adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

Open hotplate burners

May only be accurately tested with specialized equipment available in a test laboratory.

Checks should be made to ascertain that burners and pan supports are of the correct type, undamaged and correctly positioned. The burner ports and injectors must be clean and a visual inspection of the flame picture carried out.

Refrigerators

An open-ended sampling probe to be positioned within the combustion products outlet duct, in the combustion products stream and the probe position adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

Gas lights

An open-ended sampling probe to be positioned within the combustion products stream

Fixed flueless space heaters

The angled sampling probe as in fig. 1 should be positioned in the combustion products stream directly above the outlet grille. The probe position adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

Flueless water heaters

The angled sampling probe as in fig. 1 should be positioned in the combustion products stream directly above the outlet grille. The probe position adjusted until the highest steady CO₂ value or the lowest steady O₂ value is recorded.

Combustion performance (CO/CO₂ ratio) of gas appliances

The combustion performance is expressed as the ratio of carbon monoxide to carbon dioxide in the combustion products.

CO/CO₂ ratio action levels are detailed in the following table. Should higher ratios than listed in Table 1 are found or an appliance type is omitted, then the appliance manufacturer should be consulted. Higher ratios than those specified in the appropriate British Standard for an appliance are unacceptable

Application type	CO2/CO rating and fuel source	Pro type
Junction unit	Bi-fuel	Use open ended probe
	Combination oil/gas	
Gas fitting zone		Use open ended probe
Gas slim		Use open ended probe
Commercial boiler		Use open ended probe
Flue gas analyser	Flue	Flue gas probe (retractable)
	Flue gas analyser	Flue gas probe (retractable) - see also standard probe (1.4.4)
Leak probe/valve	Flue	Flue gas probe (retractable)
	Control valve	Use open ended probe
Leak probe/heater (Flue)		Flue gas probe (retractable)
Water heater - Flue		Flue gas probe (retractable) - see also standard probe (1.4.4)
Water heater - Labels		Flue gas probe (retractable)
Warm air heater		Use open ended probe
Flue gas analyser	Flue gas	Flue gas probe (retractable) - see also standard probe (1.4.4)
	Control valve	Use open ended probe (1.4.4)
	Cooker gas	Flue gas probe (retractable) - see also standard probe (1.4.4)
Cooker gas (CE mark)	CE mark	Flue gas probe (retractable)
	Cooker gas (non CE mark)	Flue gas probe (retractable)
Range cooker/Flue		Flue gas probe (retractable) - see also standard probe (1.4.4)
Range cooker (LPG)		Use open ended probe (1.4.4)
Flue gas	Flue gas	Use open ended probe (1.4.4)
	Flue gas	Use open ended probe (1.4.4)
Gas (flue) (CO)	Flue gas	Flue gas probe (retractable) - see also standard probe (1.4.4)
	Flue gas	Flue gas probe (retractable) - see also standard probe (1.4.4)

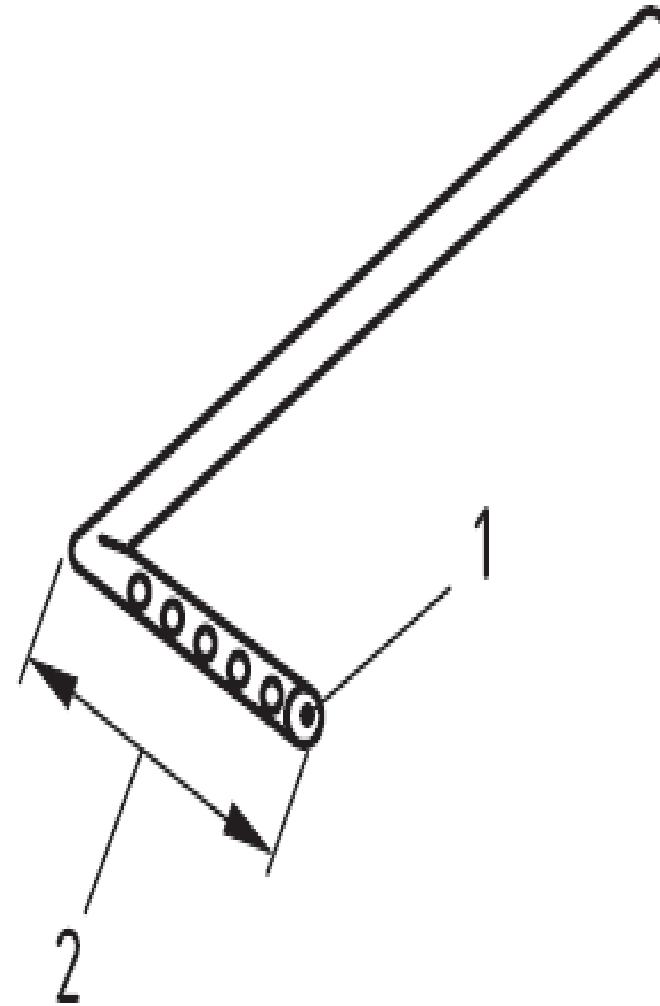
Five 1.8mm diameter sampling holes should be spread evenly along the sampling section of the probe

Probe should be 6mm malleable tube

KEY

1 Sealed end of sampling probe

2 Sampling section of 125mm

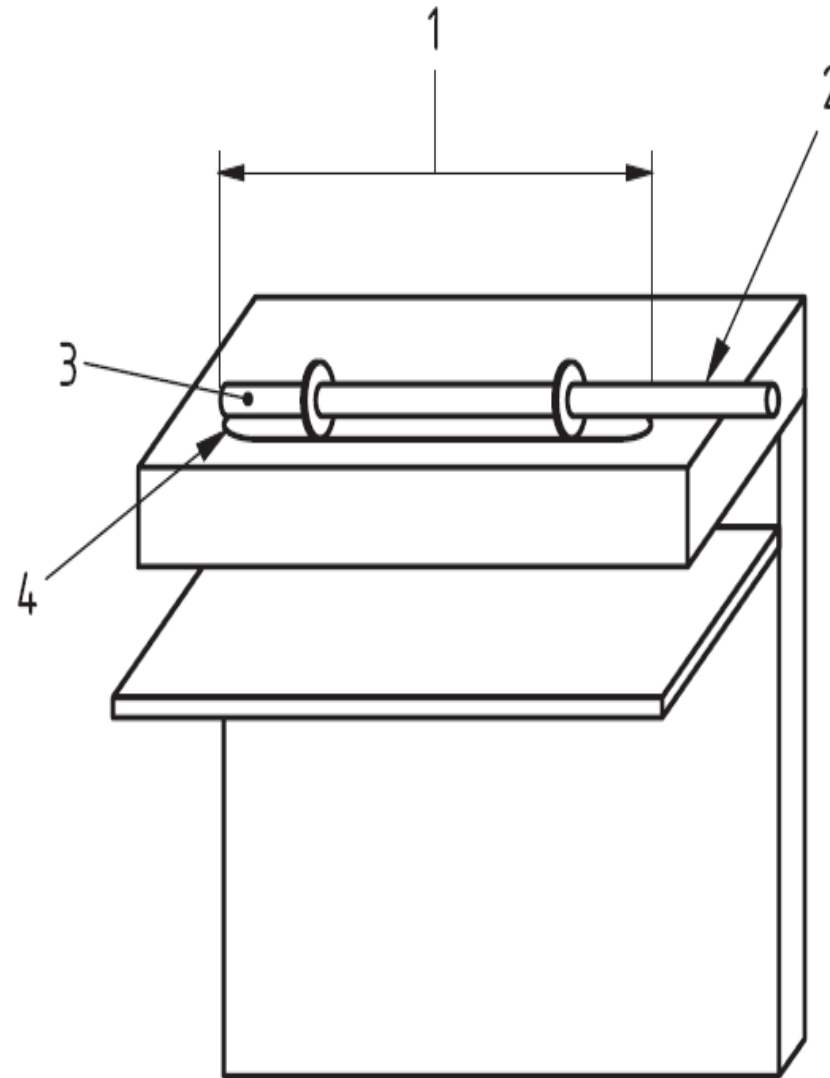


Seven 1.8mm diameter holes should be spread evenly along the sampling section of the probe

Probe should be 6mm malleable tube

KEY

- 1. Sampling section of 250mm**
- 2. Sampling probe**
- 3. Sealed end of sampling probe**
- 4. Grill outlet**







Should a CO/CO₂ ratio continue to exceed the action level or any level specified by the appliance manufacturer, the appliance should be correctly categorized under The Gas Industry Unsafe Situations Procedure.

A **flued** appliance which fails to achieve a satisfactory CO/CO₂ ratio should be deemed to be **AT RISK**

A **flueless** appliance which fails to achieve a satisfactory CO/CO₂ ratio should be deemed to be **IMMEDIATELY DANGEROUS**

Test procedure for combustion product analysis

- i) inspect the appliance to be tested to ensure that installation, flue and ventilation conforms to manufacturer's instructions
- ii) check for appliance damage, wrongly installed components and excessive dust/debris
- iii) check the operating pressure and/or heat input conforms to manufacturer's instructions
- iv) light the appliance and visually check the combustion performance and flame picture
- v) correctly assemble, confirm calibration and suitability of analyser
fit the correct sampling probe for the appliance
- vi) turn on the analyser and confirm that it is zeroed and set to the correct scale
position the sampling probe correctly
- vii) adjust the probe position to obtain the highest steady CO₂ reading and the
lowest steady O₂ reading
- viii) record the CO/CO₂ ratio
- ix) adjust appliance and components if CO/CO₂ ratio is above action level and re-
test

Additional requirements for flueless cookers are necessary

All permanent ventilation should be correct and unobstructed.

CO levels may exceed 10ppm for a short time after initial ignition of grill burners.

This is acceptable providing that the cooker is fitted in accordance with BS 6172 and that the CO level subsequently falls below 10ppm.

A flat-based saucepan of between 160mm and 220mm diameter containing approximately 1 litre of water and covered with a lid should be placed on each of the two largest hotplate burners. The grill pan should be at its highest recommended position under the grill.

Any extract fan should be operated in accordance with the cooker manufacturer's instructions.

Light the grill, oven and the two hotplate burners at maximum setting. Adjust the oven to Mark 5 or equivalent.

Record the CO levels at 1 min. intervals

Turn the hotplate burners to simmer when the water boils. Turn off the grill after 30 min.

If, during the test, the CO reading:-
begins to fall without exceeding 30ppm, stop the test – the cooker is satisfactory;

does not exceed 30ppm for longer than 20 min. and begins to fall and does not exceed 90ppm at any time stop the test – the cooker is satisfactory;

exceeds 90ppm at any time, stop the test, ventilate the room, identify the cause, rectify and repeat the test.

This procedure also applies to built-in cooking appliances.

Servicing and maintenance with the aid of a combustion gas analyser

An electronic combustion gas analyser may be used as an aid to maintain and service gas appliances in three ways:-

- i) to assess the level of servicing required.(if allowed by manufacturer's instructions)
- ii) to confirm satisfactory combustion after maintenance
- iii) to confirm satisfactory combustion after service

The use of a combustion gas analyser in no way removes the requirement to carry out operational checks as detailed in regulation 26(9) of the Gas Safety (Installation & Use) Regulations 1998 concerning checking:-

- a) flues
- b) ventilation
- c) burner pressure and/or heat input
- d) correct operation of appliance safety controls

In addition to the above checks it is necessary to include checks for:-

water leaks

heat stress

mechanical deterioration (corrosion)

condition of case seals and joints

checking manufacturer's instructions for any additional requirements such as additional controls checks and the removal and cleaning of condensate traps etc.

If electronic service overrides are employed to bypass modulating functions, these must be reset after any tests.

If a manufacturer's instructions supply only a satisfactory CO₂ figure then the CO₂ reading must comply with this figure and the CO/CO₂ ratio must be less than 0.004.

In the absence of specific manufacturers' CO/CO₂ ratio recommendations, the action levels for CO/CO₂ ratios must be applied.