B4 M.O.T. 3.4.1 – 93 GAS CONSUMPTION

B4.1 SCOPE

This test applies to all burners.

B4.2 METHOD

The appliance is supplied with the appropriate gas and the test point pressure is carefully set to the nominal value. The gas rate to all burners is measured accurately 15 min after ignition. It is necessary to obtain the dry relative density of the test gas, the gas temperature, and to note whether the gas is dry or saturated when passing through the gas meter, so that the corrected gas consumption can be calculated.

B4.3 APPARATUS

- 1 Equipment specified in Clause 3.2.6.
- 2 Suitable timing device.

B4.4 MATERIALS

Supply of appropriate test gas (see Clause 3.1.2).

B4.5 PREPARATION OF APPARATUS

- 1 The appliance shall be prepared for testing in accordance with Clause 3.2.
- 2 Supply the appropriate gas to the appliance.
- 3 Ensure that the meter is nominally at room temperature.
- 4 Ensure that any thermostat or other temperature control device has been rendered inoperative, e.g. by immersing the sensing element in cold water.

B4.6 PROCEDURE

- 1 Turn on the gas fully, light the burner(s) and set the test point pressure to the nominal value. Operate the appliance for 15 min.
- 2 Measure the total gas rate in m^3/h within the next 2 min (see Clause 3.2.6). This is the value Qm, in the following calculation.
- 3 Determine the absolute temperature, Tm, of the gas passing through the meter.
- 4 Determine the gas pressure p in kPa (meter inlet pressure).
- 5 Determine the barometric pressure Pa in kPa.
- 6 Obtain the gas relative density Dt (Air = 1.000).
- 7 From these observations calculate the Determined Gas Consumption using the following formula —

$$R = Qm \cdot \frac{(Pa + p)}{Ps} \cdot Wr \cdot \left[Dt \cdot \frac{Ts}{Tm} \cdot \frac{(Ps + h)}{(Pa + h)} \right]^{\frac{1}{2}} \cdot \left[1 - \frac{Pw}{(Pa + h)} \cdot \left(1 - \frac{Dw}{Dt} \right) \right]^{\frac{1}{2}}$$

B4 M.O.T. 3.4.1 – 93 GAS CONSUMPTION (Cont'd)

where

- R is the Determined Gas Consumption, MJ/h;
- p is the metering pressure, kPa;
- Ps is the standard absolute pressure (barometer), 101.325 kPa;
- Pa is the ambient absolute pressure (barometer), kPa;
- Wr is the Wobbe index of reference gas;
- Dt is the test gas relative density (dry);
- Ts is the standard absolute temperature, (273.15 + 15.0) K;
- Tm is the meter absolute temperature, K;
- h is the injector pressure (nominal test point pressure), kPa;
- Pw is the water vapour absolute pressure (partial press) at Tm, kPa;
- Dw is the water vapour relative density, 0.622.

NOTE: The last term in the square brackets equals unity (1) for natural gas, town gas and all dry gases.

Table B1 gives Wr values for all reference gases.

TABLE B1

Reference gas	Wr
TG	26.0
TLP	23.8
NG	50.0
Propane	76.9
Butane	87.2

Wr VALUES (DRY BASIS) FOR ALL REFERENCE GASES

B4.7 RESULT

The appliance complies with these requirements if the determined gas consumption is within 5% of nominal gas consumption.

B5 M.O.T. 3.6.1.1/3.6.1.3 – 85 IGNITION AERATED PILOTS

B5.1 SCOPE

This test applies to all aerated pilots.

B5.2 METHOD

The pilot burner is tested to see if it can be operated in the lit back condition. If this condition can be established the pilot flame shall light the main burner or cause a safety shut off valve to close. The test is then repeated with the primary air opening closed.

If the pilot burner has more than one flame port the tests are repeated with all ports blocked other than the one activating the flame safeguard sensor.

B5.3 APPARATUS

- 1 Equipment as specified in Clause 3.2.6.
- 2 Suitable timing device.

B5.4 MATERIALS

Supply of appropriate test gas (see Clause 3.1.2) at normal test gas pressure.

B5.5 PREPARATION OF APPARATUS

Prepare the appliance in accordance with Clause 3.2.

B5.6 PROCEDURE

- 1 Attempt to light back pilot burner. If a lit back condition cannot be established then the requirement of Clause 3.6.1.1(a) is not applicable.
- 2 Supply gas to the main burner.
- 3 Observe that main burner ignites positively within 5 s or that pilot causes the safety shut off valve to close.
- 4 Turn off main burner and pilot.
- 5 Close the pilot primary air opening and attempt to relight pilot. If the pilot cannot be established then the requirement of Clause 3.6.1.1(b) is not applicable.
- 6 Repeat Steps 2 and 3.
- 7 If the pilot burner has more than one flame port, repeat Procedures 1 to 7 with all ports blocked other than the one activating the flame safeguard sensor.

B5.7 RESULTS

An aerated pilot complies with the requirements of Clauses 3.6.1.1 and 3.6.1.3 if it ignites the main burner promptly and without undue noise within 5 s or causes a safety shut off valve to close when —

- (a) it is operated in a lit back condition;
- (b) the primary air opening is closed; and
- (c) all ports other than the one activating the flame safeguard sensor are blocked (if applicable).

B6 M.O.T. 3.6.1.2/3.6.1.3 – 85 IGNITION OF BURNER PROTECTED BY A FLAME SAFEGUARD

B6.1 SCOPE

This test applies to all burners which are protected by a flame safeguard actuated by a pilot.

B6.2 METHOD

The pilot burner is adjusted to just keep the flame safeguard open. At this setting it shall ignite the main burner when tested at nominal gas consumption and at any other rate at which it can be controlled automatically. If the pilot burner has more than one flame port, the test is repeated when all ports are blocked other than the one activating the flame safeguard sensor.

B6.3 APPARATUS

Equipment as specified in Clause 3.2.6.

B6.4 MATERIALS

Supply of appropriate test gas (see Clause 3.1.2).

B6.5 PREPARATION OF APPARATUS

Prepare the appliance in accordance with Clause 3.2.

B6.6 PROCEDURE

- 1 Light the gas at both pilot and main burners.
- 2 Adjust the gas consumption of the main burner so that it is within \pm 5% of the nominal gas consumption.
- 3 Turn off the main burner.
- 4 Reduce the gas rate to the pilot in small steps. At each reduction light the main burners, then turn off gas to main burner.
- 5 Continue to reduce the gas rate to the pilot in small steps until either
 - (i) ignition of the main burner is unsatisfactory; or
 - (ii) the flame safeguard shuts off the gas supply.
- 6 Repeat Steps 4 and 5 with all ports blocked other than the one activating the flame safeguard sensor.
- 7 Repeat Steps 4, 5 and 6 with the main burner reduced to the lowest rate at which it can be controlled automatically.

B6.7 RESULT

The appliance complies with this requirement if no unsatisfactory or explosive ignition of the main burner takes place before the flame safeguard shuts off the gas supply.

B7 M.O.T. 3.6.1.13 – 88 OPERATION OF FLAME SAFEGUARD

B7.1 SCOPE

This test applies to all appliances fitted with a flame safeguard.

B7.2 METHOD

The appliance is operated at nominal gas consumption for 1 h or until thermal equilibrium is reached. The gas is then turned off and the time taken for the gas valve to close is determined.

B7.3 MATERIALS

- 1 Supply of appropriate test gas (see Clause 3.1.2) at normal test gas pressure.
- 2 Air at normal test gas pressure.

B7.4 APPARATUS

- 1 Equipment as specified in Clause 3.2.6.
- 2 Two-way valve.
- 3 Suitable timing device.
- 4 Air flow meter of adequate capacity.

B7.5 PREPARATION OF APPARATUS

- 1 Place the appliance in a draught-free location.
- 2 Set up test equipment.
- 3 Prepare the appliance in accordance with Clause 3.2.
- 4 Connect two-way valve at the appliance inlet with one inlet connected to gas supply and the other to air supply.
- 5 Connect air flow meter into the air supply.

B7.6 PROCEDURE

- 1 With the appliance at room temperature light the gas at burners.
- 2 Operate with normal test gas pressure at appliance inlet for 1 h or until thermal equilibrium is reached.
- 3 Turn two-way valve from gas supply to air supply.
- 4 Observe actuating flame and start the timing device at the instant the flame extinguishes.
- 5 Stop the timing device at cessation of flow of air as indicated by flow meter.

B7.7 RESULT

The flame safeguard meets this requirement if the observed time does not exceed —

- (a) 90 s where atmospheric type main burners are used and the total gas consumption is up to and including 50 MJ/h;
- (b) 60 s where atmospheric type main burners are used and the total gas consumption exceeds 50 MJ/h up to and including 150 MJ/h;
- (c) 45 s where atmospheric type main burners are used and the total gas consumption exceeds 150 MJ/h up to and including 500 MJ/h;

B7 M.O.T. 3.6.13 – 88 OPERATION OF FLAME SAFEGUARD (Cont'd)

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- (d) 15 s for all other types of main burner up to and including 150 MJ/h; and
- (e) 3 s for all other types of main burner.

B8 M.O.T. 3.6.2.2 (iii)/3.6.3.1 (iii) – 94 START FLAME ESTABLISHMENT PERIOD - DELAYED IGNITION TESTS

B8.1 SCOPE

This test applies to all burners with automatic ignition systems which are not based on permanent pilots and which do not comply with any other requirements of Clause 3.6.2.2 or Clause 3.6.3.1, as applicable.

B8.2 METHOD

The normal start flame establishment period is timed. The automatic ignition system is then bypassed so that the start gas flow and spark initiation are under manual control. Ignition tests are carried out at various delay periods up to twice the determined start flame establishment period and it is observed whether ignition is complete and effective.

B8.3 APPARATUS

- 1 Equipment as specified in Clause 3.2.6.
- 2 Suitable timing device.

B8.4 MATERIALS

- 1 Supply of appropriate test gas (see Clause 3.1.2) at normal test gas pressure.
- 2 Electricity supply at the required voltage.

B8.5 PREPARATION OF APPARATUS

NOTE: Before attempting delayed ignition tests ensure there is adequate explosion relief opening (refer to AS 1375). For safety reasons, the delay from zero should be increased in small steps.

- 1 Set up appliance in accordance with Clause 3.2.
- 2 Using the timing device, measure the start flame establishment period with the ignition system operating through the normal sequence without gas flow. Record the time.
- 3 Bypass the automatic ignition system in a manner which will provide manual control of the start gas flow and spark initiation.

B8.6 PROCEDURE

- 1 Initiate gas flow and ignition spark simultaneously.
- 2 Over successive tests, gradually increase the delay period between initiation of start gas flow and initiation of ignition spark until the time interval is twice the determined start flame establishment period.
- 3 As this is a safety test under abnormal operation, explosive noise and flame roll-out may be acceptable provided
 - (i) there is no damage to the appliance;
 - (ii) the burner does not light back; and
 - (iii) there is no danger to persons or adjacent property.
- 4 The extent of any flame roll-out at the appliance perimeter and at the flue outlet shall be reported.

B8.7 RESULT

The appliance complies with this requirement if ignition up to twice the start flame establishment period is satisfactory with no excessive noise or evidence of flame outside the appliance.

B9 M.O.T. 4.2 – 95 DETERMINATION OF CO/CO₂ RATIO OF COMBUSTION PRODUCTS - SURFACE COMBUSTION BURNERS

B9.1 SCOPE

This test applies to all appliances incorporating surface combustion burners.

B9.2 METHOD

The combustion products are sampled by means of an appropriate hood or other appropriate device and analysed for CO and CO₂.

B9.3 APPARATUS

- 1 Equipment as specified in Clause 3.2.6.
- 2 Flue gas sampling hood or other device of stainless steel or aluminium (see Figure A2((a) or A2(b)).
- 3 Carbon monoxide analyser, calibrated to give accurate and reproducible results.
- 4 Carbon dioxide analyser, calibrated to give accurate and reproducible results.
- 5 Suitable timing device.

B9.4 MATERIALS

Appropriate gases as listed in Table B2.

TABLE B2

LIMITING CONDITIONS—INDEPENDENT SURFACE COMBUSTION BURNER

	Test gas	Appliance inlet pressure	Limiting condition
NG	N	0.75 kPa	
Propane	X, Z	2.00 kPa	4h a lassa at an anatin a
Butane	Y	2.00 kPa	setting to which the
Universal LPG	X, Z	2.00 kPa	burner control can be
TLP	Т	0.50 kPa	set
TG	D	0.50 kPa	

B9.5 PREPARATION OF APPARATUS

- 1 Set up the appliance in an accessible draught-free position in accordance with Clause 3.2.
- 2 Connect the appropriate gas as shown in Table B2.
- 3 Ensure that any thermostat or other temperature control device is rendered inoperative, e.g. by immersing the sensing element in cold water.
- 4 Place appropriate sampling hood or other device above the appliance, or in a position to obtain a satisfactory sample of combustion product.

B9.6 PROCEDURE

- 1 Adjust the aeration setting, where fitted, to the minimum setting for burners intended for luminous flame effect.
- 2 Light the burner(s).

B9 M.O.T. 4.2 – 95 DETERMINATION OF CO/CO₂ RATIO OF COMBUSTION PRODUCTS - SURFACE COMBUSTION BURNERS (Cont'd)

- 3 Immediately adjust the appliance inlet pressure to
 - (i) 0.75 kPa for a NG appliance;
 - (ii) 2.0 kPa for an LPG appliance;
 - (iii) 0.5 kPa for a TLP or TG appliance.
- 4 After 5 min operation at the reduced inlet pressure, reduce the burner control to the lowest operating setting.
- 5 5 min after reducing the pressure to an indoor flueless appliance, or 10 min after reducing the pressure to any other type of appliance, determine CO and CO_2 by the use of the specified apparatus.

B9.7 RESULT

The appliance complies with this requirement provided the CO/CO₂ ratio does not exceed—

- (a) 0.007 after B9.6 step 5 for an indoor flueless appliance; or
- (b) 0.02 after B9.6 step 5 for any other type of appliance.

B10 M.O.T. 4.3 – 95 DETERMINATION OF CO/CO₂ RATIO IN FLUE PRODUCTS

B10.1 SCOPE

This test applies to all appliances.

B10.2 METHOD

The flue products are sampled by means of an appropriate hood and analysed for CO and CO_2 .

B10.3 APPARATUS

- 1 Equipment as specified in Clause 3.2.6.
- 2 Flue gas sampling hood of stainless steel or aluminium (see Figure A2(a) or A2(b)).
- 3 Carbon monoxide analyser, calibrated to give accurate and reproducible results.
- 4 Carbon dioxide analyser, calibrated to give accurate and reproducible results.
- 5 Suitable timing device.

B10.4 MATERIALS

Appropriate test gases as listed in Table B3.

TABLE B3

LIMITING CONDITIONS—ALL BURNERS

	Limit gas	Actual gas consumption (% of nominal gas consumption)
NG	Ν	120
Propane	X, Z	113
Butane	Y	113
Universal LPG	Υ, Ζ	125
TLP	Т	120
TG	D	120

B10.5 PREPARATION OF APPARATUS

- 1 Set up the appliance in an accessible draught-free position in accordance with Clause 3.2.
- 2 Connect the appropriate test gas in accordance with Table B3.
- 3 Light the burner and operate for 15 min.
- 4 Adjust the overload gas rate as specified in Table B3 and corrected as in Appendix D.

The specified overload conditions shall be obtained by adjusting the inlet pressure with the appliance regulator at its nominal setting. If the overload condition cannot be obtained with a maximum inlet pressure of 3.0 kPa then the appliance regulator shall be rendered inoperative or bypassed.

- 5 Turn off the burner and allow appliance to cool.
- 6 Place the appropriate sampling hood above the flueway outlet.