7.3 EXHAUST EMISSIONS - SPARK IGNITION - GENERAL Appendix 2

This inspection applies to all spark ignition engined vehicles with four or more wheels in Classes IV and VII.

Contained within this section are flowcharts. Carefully use these flowcharts to accurately establish which type of emission test is applicable to the vehicle being tested.

Vehicles fitted with modified engines: If an engine has been modified in any way, it still has to meet the exhaust emission requirements according to the age of the vehicle.

Personal Imports: The vehicle will be tested according to its age from first use. The only exemption to this is if the vehicle owner can present to the tester at time of test a letter from the vehicle manufacturer stating that the particular engine as originally installed could not meet the equivalent British emission standards. If this is the case, then test to the next lower emission standard.

e.g. A 1995 car first used in Africa has a letter from the engine manufacturer stating that the particular engine (engine number to be stated) cannot meet Catalyst emission limits, then use the pre cat limits of CO 3.5%, HC 1200ppm.

Vehicles fitted with a different engine:

Test according to which is older, engine or vehicle.

e.g. A 1995 car fitted with a 1991 engine (of whatever make), test to 1991 standards for emission purposes.

Note: The onus is on the vehicle presenter to prove engine age.

The following notes should be used in conjunction with the flowcharts on the following pages.

(1) Two stroke engines do not require an emissions test unless they are subject to the catalyst test.

(2) <= less than or equal to

(3) **Advice on establishing whether the design gross weight of a large car exceeds 2500kg**

- (i) it may be shown on the manufacturers VIN plate (example shown in Section 3.9)
- (ii) it may be listed only in Section 2 of the current emissions data book
- (iii) refer to any readily available data, e.g. handbook or data book
- (iv) if still unsure, assume it to be over 2500kg DGW.

(4) Vehicles, which have been the subject of specialist conversions, are to be treated, for emissions purposes, as if they had not been converted, e.g. a motor caravan or ambulance converted from a goods vehicle is still to be treated as **not being** a "**passenger car**"; an ambulance converted from a "**passenger car**" or a "**passenger car**" with seats added is still to be treated as **being** a "**passenger car**".

A vehicle originally built with 6 or more seats, in addition to the driver, which has had seats removed is still to be treated as **not being** a"**passenger car**".

(5) The full title of the Department of Transport Emissions book is "In-Service Exhaust Emission Standards for Road Vehicles". The latest edition must be used.

Information	Method of Inspection	Reason for Rejection
Engine speed and temperature When checking exhaust emissions, the engine must be at its normal idle speed and normal operating temperature. Engine speeds and temperature can be assessed either subjectively or by reference to manufacturer's or other reliable data. **Gas analyser probe** It is important to ensure that the gas analyser probe is inserted as fully as possible into the exhaust pipe and is secure. **Recording emissions test results** Record the results of the tests via the VTS Device. (See Introduction paragraph 3 at the beginning of this Inspection Manual)	**A. All vehicles** 1. Raise the engine speed to around 2500 rpm or half the maximum engine speed if this is lower. Hold this speed steady for 20 seconds to ensure that the inlet and exhaust system is properly purged. Allow the engine to return to idle and the emissions to stabilise	**A. All vehicles** 1. The engine

Non-catalyst test

1. The Exhaust Emission Test

A check of exhaust emissions is part of the MOT test for all 4-stroke spark ignition engined vehicles with 4 or more wheels in Classes IV and VII.

Two of the exhaust gases are included

- carbon monoxide (CO)
- hydrocarbons (HC)

Assessment on most vehicles is straightforward, but a number of factors should be borne in mind.

2. Conducting the Test

3. Electric engine cooling fans

Many modern vehicles are fitted with electric engine cooling fans which can cut in during an emission test. The extra load on the alternator reduces the idle speed, which causes the engine management system to react. This gives rise to highly variable readings.

If this happens during a test, wait until the fan switches off and the readings stabilise before continuing.

4. Unstable readings

Some vehicles give unstable readings due, for example, to their carburettor or fuel injection system design. Before failing a vehicle, it is important to establish that a particular limit has been exceeded constantly for a period of 5 seconds.

5. [illegible]

6. Total gas emitted

The MOT limits prescribed relate to the total exhaust gas being emitted by the vehicle.

If a vehicle has a dual exhaust system, then the emissions from the tailpipes should be averaged. This is done by adding together the readings and dividing by two, eg

1st pipe emits 6% CO, 400 ppm HC

2nd pipe emits 4% CO, 500 ppm HC

7. Multi fuel vehicles

Vehicles which run on more than one fuel(eg petrol and LPG) should be tested on the fuel they are running on when presented.

There is a slight difficulty with LPG vehicles: the hydrocarbons emitted are propane rather than hexane. So the HC reading obtained must be divided by the "propane/hexane equivalency factor" (PEF) marked on the gas analyser. For example:

An LPG vehicle gives a reading of 700 ppm.
The PEF marked on the machine is 0.48.
So the actual MOT value is:

$$\frac{700}{0.48} = 1458 \text{ ie fail}$$

Some exhaust gas analysers have an automatic facility for doing this.

8. Vehicles which only just pass

Many modern vehicles will normally run well below the MOT limits. Where such a vehicle just passes the MOT test, but the tester knows that it is capable of more efficient operation, the owner should be informed. Vehicles should normally be tuned to the manufacturer's recommended settings wherever possible, but tuning is **not** part of the MOT test.

9. Vehicles which are incapable of passing

Regulations do not require vehicles to achieve CO or HC readings below the original capability of the engine when new.

A very few vehicles may never have been able to meet the MOT limits.

Where a vehicle owner claims that this is the case, and has sound supporting evidence (eg a letter from the vehicle manufacturer), the vehicle should be considered exempt from the CO and HC emission requirements.

If the owner does not have sound supporting evidence, a Test Certificate should be refused.

Catalyst test

1. The exhaust emission test

The catalyst test is part of the MOT test for most class IV spark ignition petrol engined passenger cars with four or more wheels first used on and after 1 August 1992.

Carbon monoxide (CO), hydrocarbons (HC) and lambda (λ) are checked at fast idle speed and carbon monoxide (CO) is checked again at idle speed.

The test should be self explanatory using the automated routine on 1996 specification exhaust gas analysers. The following points should be borne in mind.

2. Electric cooling fans and other accessories

If, during the catalyst emission test, the engine cooling fan cuts in or out, this is not a problem and the test should continue as normal.

All other vehicle accessories (eg headlamps, air conditioning, heaters) shall be **turned off** during the test.

3. Total gas emitted

This paragraph should be read in conjunction with paragraph 6, non-catalyst test .

If a vehicle, which is subject to the catalyst emissions test, has a dual exhaust system, the test should be performed on both tail pipes and the results averaged. This is done by adding together the results and dividing by two, eg

Fast idle test

1st pipe: 0.4% CO, 25ppm HC, λ = 1.01

2nd pipe: 0.2% CO, 15ppm HC,λ = 1.03

$$\text{AVERAGE CO: } \frac{0.4 + 0.2}{2} = 0.3\%$$

$$\text{AVERAGE HC: } \frac{25 + 15}{2} = 20\text{ppm}$$

$$\text{AVERAGE } \lambda\text{: } \frac{1.01 + 1.03}{2} = 1.02$$

Idle test

$$\text{Average CO: } \frac{0.45 +}{2} = 0.4\%$$

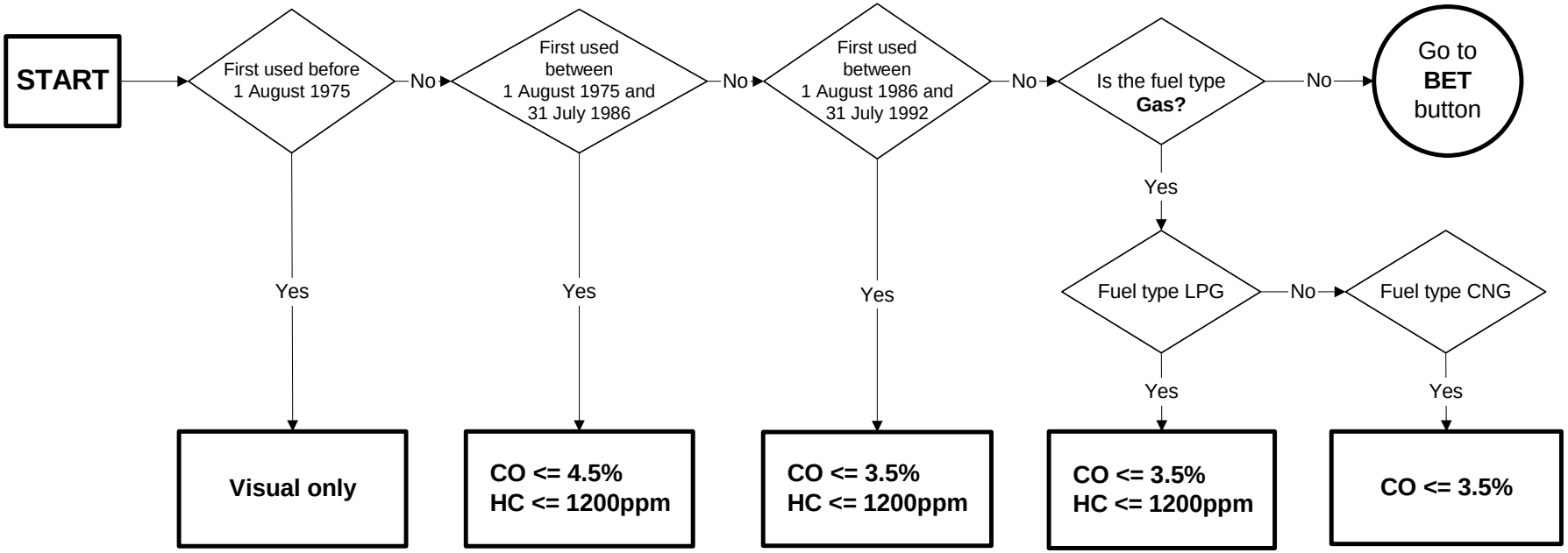
The results of this type of test must be entered manually onto the VTS Device.

4. Holed exhaust

see paragraph A5, non-catalyst test.

Information	Method of Inspection	Reason for Rejection
When to do the test It is recommended that the engine is tested as soon as possible after driving on the road.	**B. Vehicles first used on or after 1 August 1975** 1. Check that the analyser probe can be inserted into the tailpipe. 2. Use a suitable exhaust gas analyser to determine the proportions of carbon monoxide (CO) and hydrocarbons (HC) in the exhaust gas over a period of at least 5 seconds at idle. **Note:** Any residual hydrocarbons (ie those indicated by the analyser when it is sampling only clean air) should be deducted from the HC reading obtained from the vehicle. **Note:** If a vehicle meets the CO requirement at its normal idling speed but fails the HC check, re-check the HC level at a high idle speed of 2000rpm. If the HC reading is then 1200ppm or less, the vehicle will meet both the CO and HC requirements. ▪ the CO requirement must be met with the engine running at its normal (low) idling speed ▪ do not use a cold start/cold running mechanism to achieve a high idle speed. Instead, apply light pressure to the throttle pedal. HC not applicable to Compressed Natural Gas (CNG) fuelled vehicles.	**B. Vehicles first used on or after 1 August 1975** 1 The emissions cannot be measured because a tailpipe accessory is fitted which prevents insertion of the analyser probe 2 The exhaust gas contains a. a carbon monoxide content exceeding the limit for a continuous period of 5 seconds b. a hydrocarbon content exceeding the limit for a continuous period of 5 seconds.

Emission test and limits selection



Information: *All Non Catalyst Tests*

This inspection applies to:
All spark ignition engined vehicles with four or more wheels in Class IV and VII.

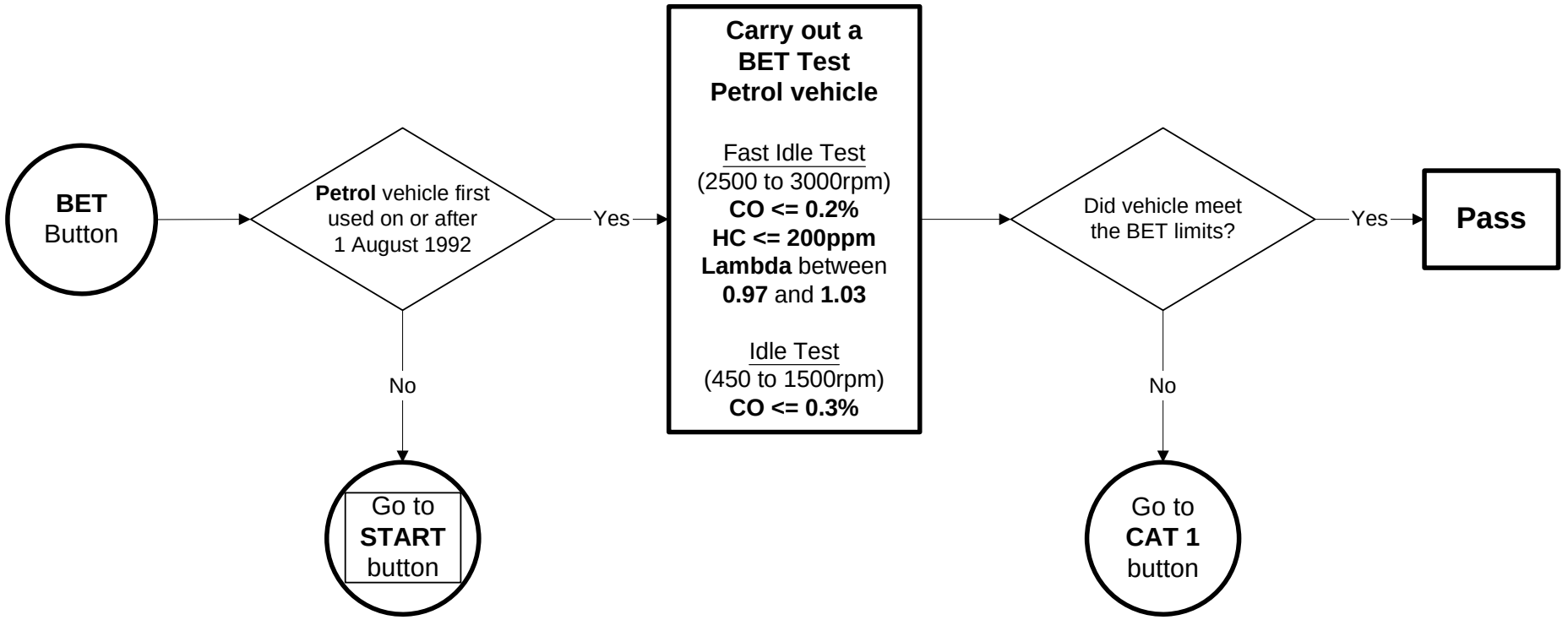
1. Use the flowchart to select the correct limits and emission test.

2. When using the flowchart reference should be made to the notes on page 1

For emissions purposes only, kit cars and amateur built vehicles first used before 1 August 1998 and Wankel rotary-engined vehicles first used before 1 August 1987 are to be considered first used before 1 August 1975.

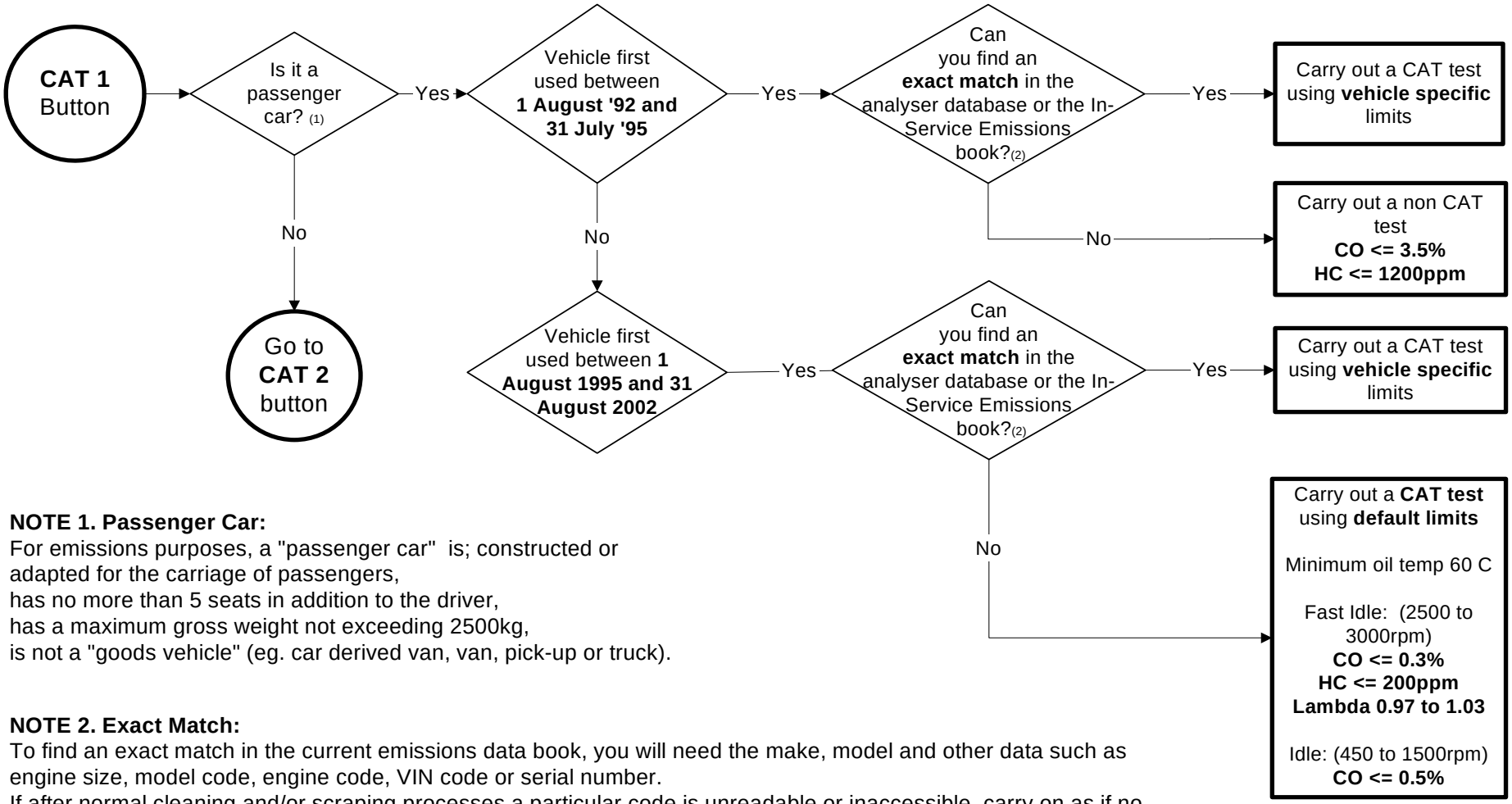
Kit cars and amateur built vehicles first used on or after 1 August 1998 ("S" reg) are required to obtain Single Vehicle Approval and should be tested to the limits stated on the log book / registration certificate.

Information	Method of Inspection	Reason for Rejection
Printouts The 1996 specification analysers will produce two printouts. One printout must be retained by the VTS for a period of three months. The other printout must be given to the vehicle presenter. **Gas analyser probe** It is important to ensure that the gas analyser probe is inserted as fully as possible into the exhaust pipe and is secure.	1. a. A suitable exhaust gas analyser will be needed to perform this inspection. Check that the analyser probe can be inserted into the tailpipe b. Ensure that the analyser's daily leak check has been performed.	1 The emissions cannot be measured because a tailpipe accessory is fitted which prevents insertion of the analyser probe.



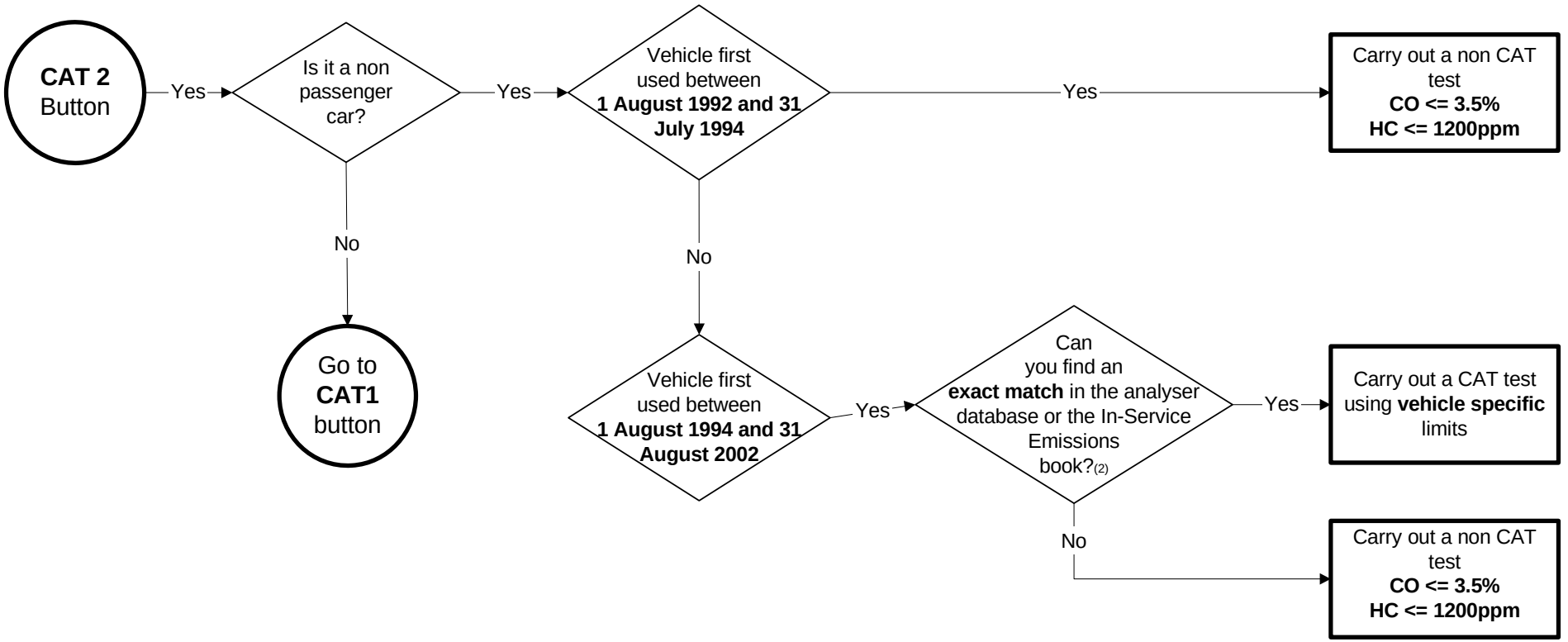
Notes for BET test

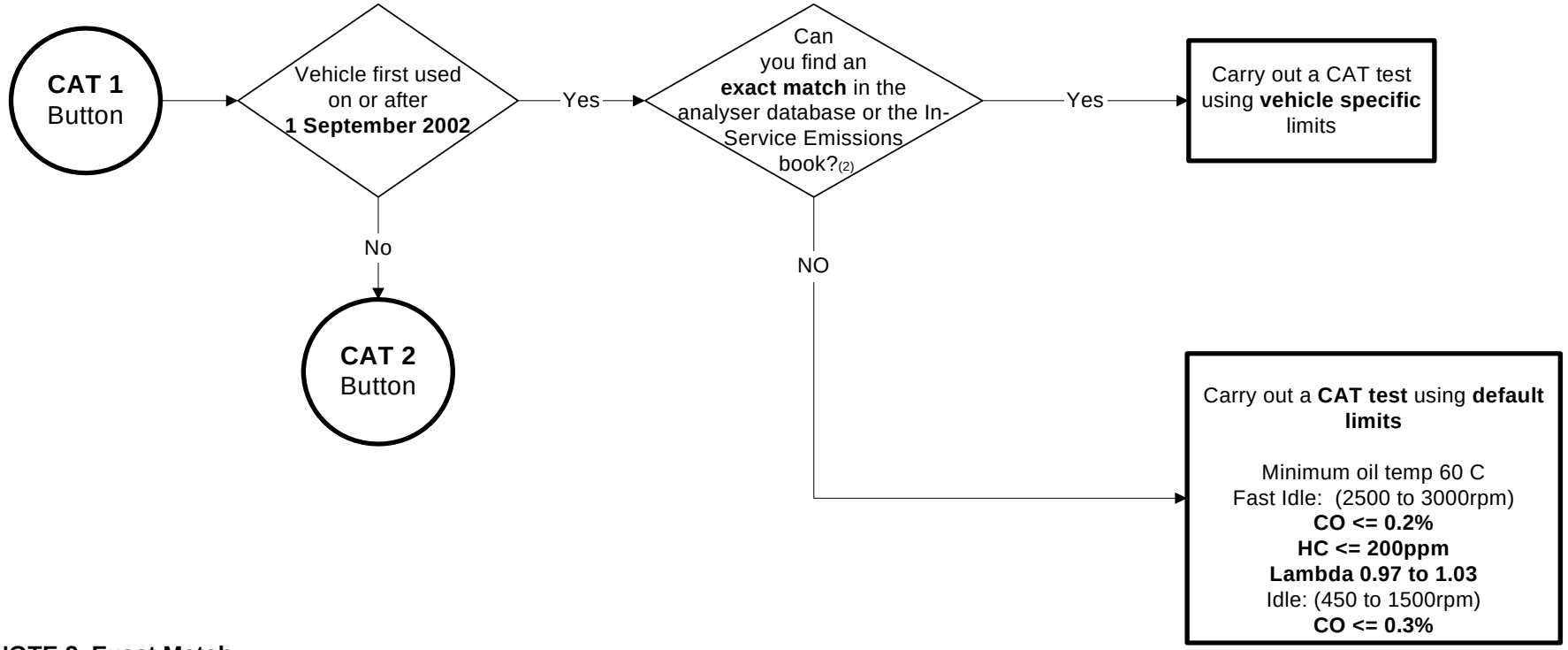
1. Ensure that the engine is hot enough to test
   eg. temperature gauge, cooling fan cut-in or hot coolant hoses.
2. Ensure that the engine idle speed is normal.
3. For the purposes of this test an engine speed measuring device will normally be required.



NOTE 1. Passenger Car:
For emissions purposes, a "passenger car" is; constructed or adapted for the carriage of passengers,
has no more than 5 seats in addition to the driver,
has a maximum gross weight not exceeding 2500kg,
is not a "goods vehicle" (eg. car derived van, van, pick-up or truck).

NOTE 2. Exact Match:
To find an exact match in the current emissions data book, you will need the make, model and other data such as engine size, model code, engine code, VIN code or serial number.
If after normal cleaning and/or scraping processes a particular code is unreadable or inaccessible, carry on as if no exact match can be found.
If the flow chart leads to a non catalyst test then carry out that test.
If the flow chart leads to a catalyst test to default limits, then carry out that test, but use the less demanding of either the default limits or the specific limits for any vehicle which is an exact match in everything but an unreadable code.


CAT 2 Button
Yes
Is it a non passenger car?
Yes
Vehicle first used between 1 August 1992 and 31 July 1994
Yes
Carry out a non CAT test CO <= 3.5% HC <= 1200ppm
No
Go to CAT1 button
No
Vehicle first used between 1 August 1994 and 31 August 2002
Yes
Can you find an exact match in the analyser database or the In-Service Emissions book?(2)
Yes
Carry out a CAT test using vehicle specific limits
No
Carry out a non CAT test CO <= 3.5% HC <= 1200ppm



NOTE 2. Exact Match:
To find an exact match in the current emissions data book, you will need the make, model and other data such as engine size, model code, engine code, VIN code or serial number.
If after normal cleaning and/or scraping processes a particular code is unreadable or inaccessible, carry on as if no exact match can be found. Test to default limits, carry out that test, but use the less demanding of either the default limits or the specific limits for any vehicle which is an exact match in everything but an unreadable code.

7.3 EXHAUST EMISSIONS - SPARK IGNITION – ALL VEHICLES USED ON OR AFTER 1 SEPTEMBER 2002

Appendix 2

Information

When to do the test

It is recommended that the extended test is carried out as soon as possible after the BET Test. This allows the test to be carried out on a fully warmed up engine.

Printouts

The 1996 specification analysers will produce two printouts. One printout must be retained by the VTS for a period of three months. The other printout must be given to the vehicle presenter.

Cosmetic engine covers

Where engine speed can only be measured by the removal of a cosmetic engine cover, the engine speed must be measured if the cover can be easily un-clipped. Otherwise, engine speed measurement may be by-passed.

Method of Inspection

1. A suitable exhaust gas analyser will be needed to perform this inspection. Check that the analyser probe can be inserted into the tailpipe
2.
   a. Ensure that the analyser's daily leak check has been performed
   b. identify the vehicle specific test limits using the flow charts
   c. connect the engine speed measuring device and insert the engine oil temperature measuring probe into the dipstick hole

      Note: Engine speed and engine oil temperature must be measured whenever possible. If engine speed cannot be measured then the vehicle tachometer should be used if fitted. Otherwise, a subjective estimate should be made. If engine oil temperature cannot be measured, see note in paragraph d below
   d. **engine pre-conditioning**: Check the engine oil temperature. If it is below the minimum vehicle specific requirement, raise the engine speed to between 2000rpm and 3000rpm and maintain this speed until the minimum engine oil temperature has been reached. Remove temperature measuring probe and replace dipstick

Note: Where, in exceptional circumstances, the engine oil temperature cannot be measured (eg in the case of a dry sump engine), check one of the following: temperature gauge showed warm engine, cooling fan had cut in or coolant pipes were hot.

Cont'd ⬇

Reason for Rejection

1. The emissions cannot be measured because a tailpipe accessory is fitted which prevents insertion of the analyser probe.
2.
   a. The engine idle speed is clearly above the vehicle specific limit.
      Note: If the engine speed is clearly above the vehicle specific limit and this can be easily adjusted, a tester may perform the adjustment and complete the test - the adjustment is not, however, part of the MOT test.

   b. In the 2nd fast idle test, one or more of the following exceeds the vehicle specific or default limits continuously for the last 5 seconds of the 30 second countdown:
      - Carbon monoxide (CO)
      - Hydrocarbons (HC)
      - Lambda (λ)

   c. In the idle test, the following gas exceeds the vehicle specific or default limit continuously for the last 5 seconds of the 30 second countdown
      - Carbon monoxide (CO).

Method of Inspection

e. perform a HC hang-up check and ensure that HC<20ppm before continuing. Insert the analyser sample probe

f. **1st Fast Idle Test:** Raise the engine speed to the vehicle specific fast idle speed and maintain for 30 seconds. If the engine speed drifts outside the fast idle speed range, begin the 30 second countdown again. During the last 5 seconds note the readings for CO, HC and lambda, and record the results

g. if the vehicle has passed the first fast idle test, then go to paragraph (j), otherwise go to paragraph (h)

h. **additional engine pre-conditioning:** Run the engine between 2000-3000rpm for 3 minutes or until all the emissions are within limits. If the engine speed goes outside the fast idle range, then freeze the countdown until the engine speed is within range once again

i. **2nd Fast Idle Test:** Repeat the procedure as laid down in paragraph (f), then go to paragraph (j)

j. **catalyst stabilisation:** Raise the engine speed to the vehicle specific fast idle speed and maintain for 30 seconds. If the engine speed drifts outside the fast idle speed range then begin the 30 second countdown again

k. **idle test:** Allow the engine to idle during a 30 second countdown. During the last 5 seconds, note the CO reading and record the result

l. Remove analyser sample probe and engine speed measuring device.