Technical Bulletin 143

Developed with HHIC

Title: CO and combustion ratio checks using an Electronic Combustion Gas Analyser (ECGA) when commissioning a condensing boiler incorporating air/gas ratio control valve technology.

Date issued: 10 July 2013

This Technical Bulletin provides guidance to Gas Safe registered businesses and engineers on the procedure for checking and recording the CO level and combustion ratio of the flue gases when commissioning a newly installed condensing boiler.

This procedure does not apply to service and maintenance activities involving, or requiring adjustment of the air/gas ratio control valve. Separate guidance on this is available in boiler manufacturers' instructions and Gas Safe Register TB 126.

Background

Following concerns arising from a very small number of carbon monoxide (CO) incidents involving newly-commissioned condensing boilers, the Heating and Hotwater Industry Council (HHIC), working with boiler manufacturers and other industry organisations, has developed and introduced the following generic procedure for checking and recording of CO level and combustion ratio (CO/CO_2) in the boiler flue gases as part of the commissioning process.

The measured values for CO and combustion ratio (assuming they are within expected tolerances) must then be recorded on the appropriate commissioning documentation. This will give both the customer and the registered commissioning engineer confidence (and evidence) that the boiler has been left in a safe and efficient working condition.

The checking procedure is illustrated in the form of a flowchart (see **Appendix 1**) which is designed to ensure that Electronic Combustion Gas Analyser (ECGA) measurements are carried out in a consistent and technically correct manner, so that accurate readings are obtained for recording purposes.

Note 1: *The ECGA used to carry out the measurements should be of the correct type, as specified by BS 7967.*

Use of Process Flowchart

The process flowchart included in this TB **(Appendix 1)** is intended as a generic guide. All HHIC boiler manufacturers have agreed that this process will form the basis of their own installation instructions. ***The boiler manufacturer's guidance must be followed if available.***

Boiler manufacturers have advised that CO levels and combustion ratios should be well within the limits indicated in this TB and may therefore choose to give specific "action levels" for CO and combustion ratio in their boiler instructions. In the absence of specific instructions, manufacturers have agreed that the key action levels given in this TB (*CO level less than or equal to 350ppm and Combustion Ratio less than or equal to 0.0040*) will ensure that the boiler can be considered safe.

The flowchart **(Appendix 1)** gives additional information (*see the preliminary information box directly above the flowchart*) which must be noted before carrying out the checking procedures. It then follows a process of:

- setting the boiler to maximum rate in accordance with manufacturer's instructions
- verifying flue integrity using the ECGA (where possible)

Gas Safe Register® has used its best efforts in the production of this information, but makes no warranty about the content and will not be held liable under any circumstances for any direct or indirect damages resulting from the use of this information. Users have the responsibility to ensure the information is current and relevant at the time of application. This document may not be reproduced in whole or in part without the consent of Gas Safe Register® other than for personal reference purposes only. This document is uncontrolled when printed, please visit: https://engineers.gassaferegister.co.uk, login and visit the Technical Information area for the controlled (current) copy. © Capita Gas Registration and Ancillary Services Ltd, 2013.

- checking CO and combustion ratio at maximum rate using the ECGA and taking remedial action if required
- setting the boiler to minimum rate (where possible and specified)
- checking CO and combustion ratio at minimum rate using the ECGA and taking remedial action if required

Where CO level and combustion ratio are found to be outside the specified tolerances/limits, basic remedial actions are suggested, but if these are unsuccessful then contact with the manufacturer is required (*see details in the ⬡ shaped boxes in flowchart*). No adjustment of the air/gas ratio valve should be attempted without first contacting the manufacturer's Technical Helpline for advice.

If both CO level and combustion ratio are within the expected limits the commissioning process can be completed (see details in the ⬭ shaped box in flowchart. The measured values of CO and the combustion ratio must then be recorded on the appropriate commissioning documentation.

Recording of CO level and Combustion Ratio

Assuming commissioning checks of the boiler are successful, the HHIC Benchmark Commissioning Checklist included in all UK boiler manufacturers' manuals should be used to record the CO level and combustion ratio measured. HHIC boiler manufacturers have agreed that completion of the Benchmark Checklist is regarded as a condition of manufacturer's warranty – hence failure to record CO level and combustion ratio on commissioning may affect warranty provision for the customer.

Although the current version of the Benchmark Commissioning Checklist allows an option for recording "if required", HHIC will shortly issue a revised version with a formal requirement to record CO and combustion ratio. This version will be used by all UK boiler manufacturers from April 2014 - at which time the measurement and recording of CO and combustion ratio on commissioning will be a requirement. From April 2013, it is a recommendation that existing Benchmark Checklists should be used for recording purposes.

Completion of appropriate commissioning documentation is a requirement of Building Regulations and therefore as part of their follow-up inspection processes, Gas Safe Register will defect an installation for non-compliance if the CO level and combustion ratio are not correctly recorded on the commissioning documentation.

Note 2: *Similar requirements apply in other geographical areas covered by Gas Safe Register. For details of current gas safety legislation, building legislation and industry standards for the geographical areas covered by Gas Safe Register, see the Legislative, Normative & Informative Document List (LNIDL)[(1)] at: https://engineers.gassaferegister.co.uk - login and visit the Technical Information area.*

Note 3*: Further guidance on the use of ECGAs is given in BS 7967[(2)].*

Note 4: *TB 126[(3)] provides guidance on the actions to take when undertaking work on condensing boilers incorporating Air/Gas ratio valves and can be viewed at: https://engineers.gassaferegister.co.uk - login and visit the Technical Information area.*

Note 5 *For general information about the process behind the development of Gas Safe Register Technical Bulletins and the expectations for all Stakeholders, see TB 1000[(4)] at: https://engineers.gassaferegister.co.uk - login and visit the Technical Information area.*

Bibliography [Ariel Bold – blue – 9pt]

(1) *Gas Safe Register Legislative, Normative & Informative Document List*
(2) *BS 7967 - Carbon monoxide in dwellings and the combustion performance of gas-fired appliances.*
(3) *TB 126 - Combustion performance information for condensing boilers incorporating air/gas ratio control valve technology*
(4) *TB 1000 - An introduction to Gas Safe Register Technical Bulletins*

Note: *Gas Safe Register Technical Bulletins and the Legislative, Normative & Informative Document List can be viewed at: https://engineers.gassaferegister.co.uk - login and visit the Technical Information area*

-o0o-

Gas Safe Register® has used its best efforts in the production of this information, but makes no warranty about the content and will not be held liable under any circumstances for any direct or indirect damages resulting from the use of this information. Users have the responsibility to ensure the information is current and relevant at the time of application. This document may not be reproduced in whole or in part without the consent of Gas Safe Register® other than for personal reference purposes only. This document is uncontrolled when printed, please visit: https://engineers.gassaferegister.co.uk, login and visit the Technical Information area for the controlled (current) copy. © Capita Gas Registration and Ancillary Services Ltd, 2013.

Appendix 1

FLOWCHART FOR CO LEVEL AND COMBUSTION RATIO CHECK ON COMMISSIONING A CONDENSING BOILER

Important Preliminary Information on Checks

The air gas ratio valve is factory-set and must not be adjusted DURING COMMISSIONING unless this action is recommended following contact with the manufacturer.

If any such adjustment is recommended and further checking of the boiler is required the installer/service engineer must be competent to carry out this work and to use an electronic combustion gas analyser (ECGA) accordingly.

If the boiler requires conversion to operate with a different gas family (e.g. conversion from natural gas to LPG) separate guidance will be provided by the boiler manufacturer with any conversion kit supplied and this must be followed.

PRIOR TO CO LEVEL AND COMBUSTION RATIO CHECK

The boiler manufacturer's installation instructions must have been followed (where available), gas type verified and gas supply pressure / gas rate checked as required prior to commissioning.

As part of the installation process, **ESPECIALLY WHERE A FLUE HAS BEEN FITTED BY PERSONS OTHER THAN THE BOILER INSTALLER**, visually check the integrity of the whole flue system to confirm that all components are correctly assembled, fixed and supported. Check that manufacturer's maximum flue lengths have not been exceeded and all guidance has been followed (e.g. Gas Safe Register Technical Bulletin (TB) 008 where chimney/flues are in voids).

The ECGA should be of the correct type, as specified by BS 7967

Prior to its use, the ECGA should have been maintained and calibrated as specified by the manufacturer. The installer must have the relevant competence for use of the analyser.

Check and zero the analyser IN FRESH AIR in accordance with the analyser manufacturer's instructions.

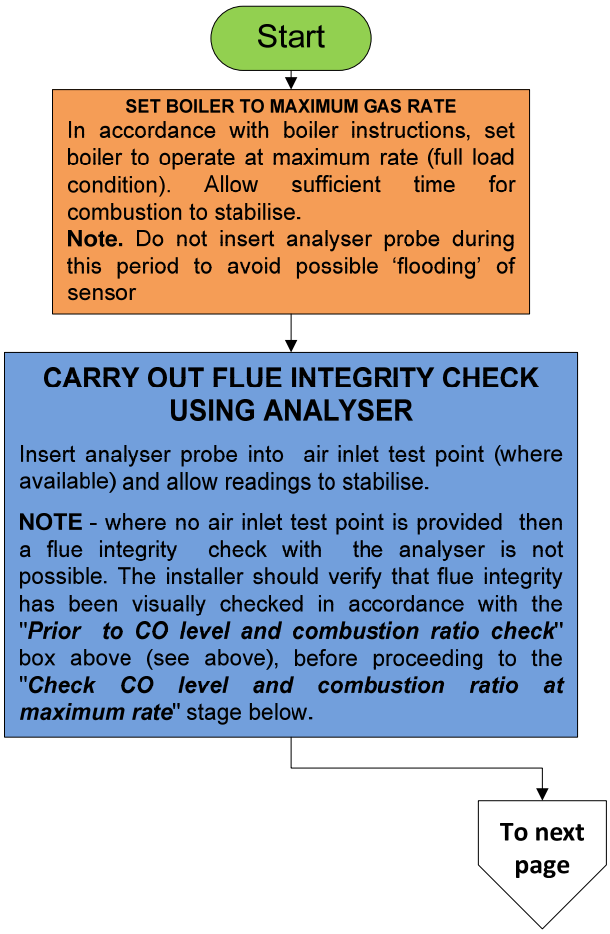
Key:

CO = carbon monoxide CO_2 = carbon dioxide **O_2** = oxygen

Combustion Ratio = The CO reading measured in ppm divided by the CO_2 reading first converted to ppm

ppm = parts per million

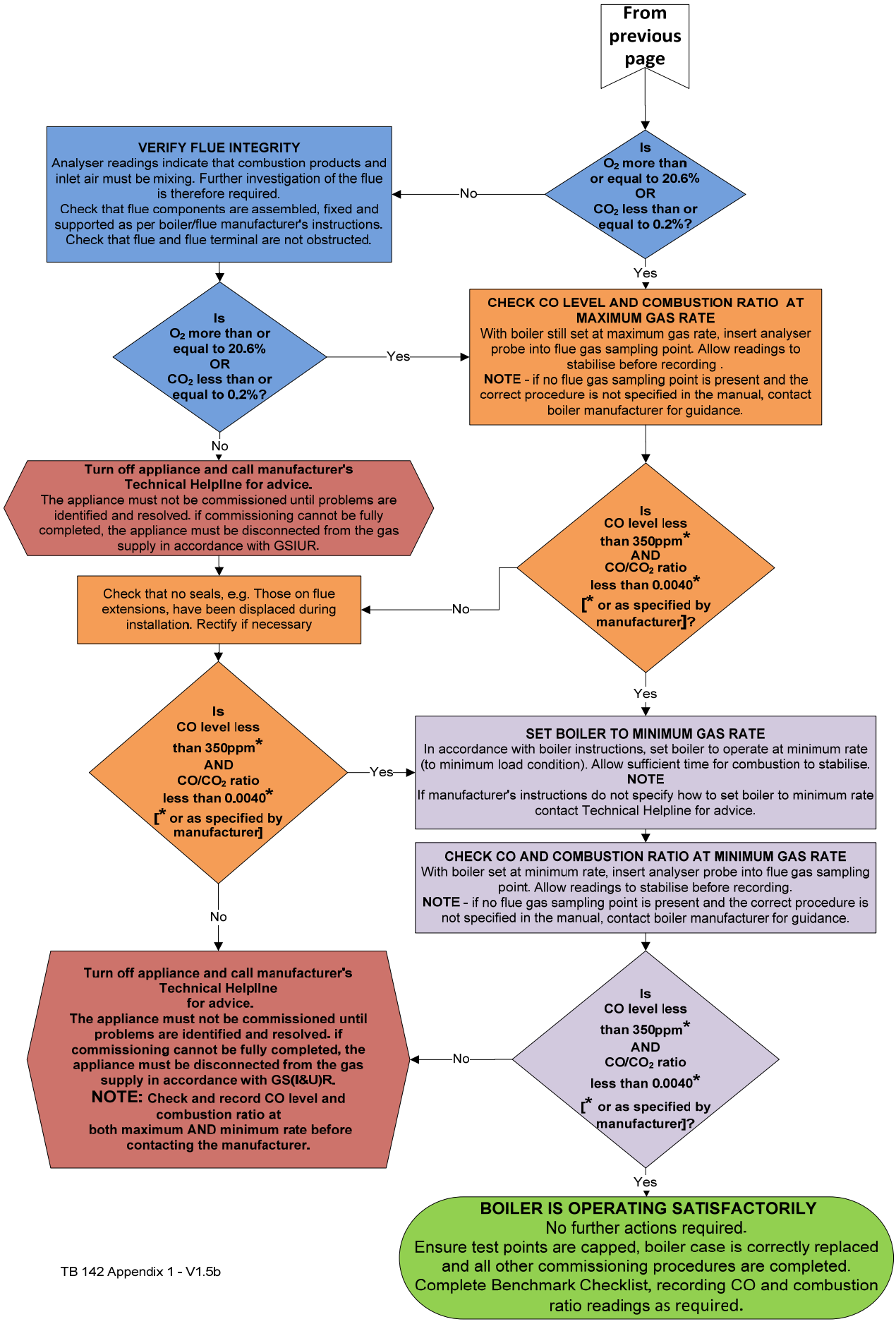
GS(I&U)R = Gas Safety (Installation and Use) Regulations



TB 142 Appendix 1 - V1.5a

Gas Safe Register® has used its best efforts in the production of this information, but makes no warranty about the content and will not be held liable under any circumstances for any direct or indirect damages resulting from the use of this information. Users have the responsibility to ensure the information is current and relevant at the time of application. This document may not be reproduced in whole or in part without the consent of Gas Safe Register® other than for personal reference purposes only. This document is uncontrolled when printed, please visit: https://engineers.gassaferegister.co.uk, login and visit the Technical Information area for the controlled (current) copy. © Capita Gas Registration and Ancillary Services Ltd, 2013.

Appendix 1 (Continued)



TB 142 Appendix 1 - V1.5b

Gas Safe Register® has used its best efforts in the production of this information, but makes no warranty about the content and will not be held liable under any circumstances for any direct or indirect damages resulting from the use of this information. Users have the responsibility to ensure the information is current and relevant at the time of application. This document may not be reproduced in whole or in part without the consent of Gas Safe Register® other than for personal reference purposes only. This document is uncontrolled when printed, please visit: https://engineers.gassaferegister.co.uk, login and visit the Technical Information area for the controlled (current) copy. © Capita Gas Registration and Ancillary Services Ltd, 2013.