

# CR 1404 on emissions from gas appliances

LABTQ – Marcogaz Workshop on Eco-design  
“Standards for Ecodesign lot 1 and lot 2- where are we?”

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## ■ CEN Report CR 1404

REPORT	CR 1404:1994
RAPPORT	
BERICHT	March 1994

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English version

Determination of emissions from  
appliances burning gaseous fuels  
during type-testing

BASIC DOCUMENT

This CEN REPORT has been established by MARCOGAZ under the supervision of the  
CEN/PC3 "Gas" and has been approved by CEN on 1993-10-28.

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France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway,  
Portugal, Spain, Sweden, Switzerland, United Kingdom.

CEN

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

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### Determination of emissions from appliances burning gaseous fuels during type-testing

Established by Marcogaz  
under the supervision of CEN/PC 3

Adopted by CEN/BT in Oct. 1993

Published by CEN in March 1994

## ■ Scope of CEN Report CR 1404

Describes **test methods** and **automatic measuring equipment for the measurement of NO<sub>x</sub> (NO+NO<sub>2</sub>), CO, CO<sub>2</sub> and O<sub>2</sub> emissions in the flue gases** including the sampling system and the calibration gases.

**Industrial gas appliances excluded** : Gas cookers, flueless appliances and appliances especially designed for use in industrial processes carried out on industrial premises are excluded from the scope.

According to their principles of analysing the combustion products, **analysers are classified** into following families:

- analysers based on the chemiluminescent effect (NO and NO<sub>2</sub>)
- analysers based on the absorption of infra-red or ultra-violet radiation (NO and NO<sub>2</sub> for concentrations above 100 ppm, CO and CO<sub>2</sub>)
- analysers based on the paramagnetic principle (O<sub>2</sub>)

Electrochemical analysers are considered inadequate for laboratory testing procedures.

**Conversion of measured levels to reference conditions** is given in Appendix 1.

## ■ Content of CEN Report CR 1404

A Introduction (NB actually Scope)

B References

C Uncertainty determination

D Main performance characteristics of analysers

E Calibration gases

F Periodical checks

G Sampling line

H Test procedures

Annex I NO<sub>x</sub> and CO : Conversion - Calculations

Annex II Practical guide to the calculation of uncertainty measurements

## ■ GLP based on CR 1404

**Good Laboratory practices** were developed in 1997/1998 based on CR 1404.

**In the framework of a project** entitled  
**« Improvement of Interlaboratory Reproducibility for NO<sub>x</sub> and CO Measurements »**

With the support of the European Commission

Version 7 – September 1998

■ Question raised within CEN/SFG\_U in September 2008 on the conversion formula between measurement conditions and reference conditions

$$NO_{x,o} = NO_{x,m} + \frac{0,02NO_{x,m} - 0,34}{1 - 0,02(h_m - 10)} (h_m - 10) + 0,85(20 - T_m)$$

Where :

**NO<sub>x,0</sub>** is the value of NO<sub>x</sub> corrected to the reference conditions expressed in milligrams per kilowatt-hour (mg/kWh);

**NO<sub>x,m</sub>** is the NO<sub>x</sub> measured at  $h_m$  and  $T_m$  in milligrams per kilowatt-hour (mg/kWh) in the range 50 mg/kWh to 300 mg/kWh;

**$h_m$**  is the humidity during the measurement of NO<sub>x,m</sub> in g/kg in the range 5 g/kg to 15 g/kg;

**$T_m$**  is the ambient temperature during the measurement of NO<sub>x,m</sub> in °C in the range 15 °C to 25 °C ...”

## ■ Issue of update of CR 1404 raised within CEN/SFG\_U in September 2008

Questions raised to the SFG\_U Members are :

- CEN CR 1404 is neither available as CEN publication nor as national publication – Further actions needed to publish it as CEN/TR 1404 ?
- **what formula shall be applied** where **humidity** and **ambient temperature** are **out of the described ranges** ?
- **what formula shall be applied** where the value ( $\text{NO}_{x,m}$ ) is **out of the range (50-300 mg/kWh)** (lower value is very high for new boilers) ?
- the reference conditions for combustion air for Types B boilers seems to be those of the test laboratory (test chamber), but for Types C (EN 483) what is the location of the ambient temperature measurement?

## ■ Issue of update of CR 1404

After CEN/PC 3 being dismissed,

**CEN/TC 238 Test gases – test pressures – appliances categories**

(in charge of EN 437 bearing the same name)

Was given the responsibility of maintaining CR 1404.

At its plenary meeting in January 2009, CEN/TC 238 took a resolution on a NWIP for revising CR 1404.

CEN/TC 238/WG 2 was set up for this purpose.

I was appointed as convenor of this WG.



## ■ Assessment of issue at stake by CEN/TC 238/WG 2

**How to be able to delete distortion on the market of appliances, due to the measurements carried out in various labs : the correction necessary to compensate for differences in temperature and humidity test conditions is not defined for the low NOx levels that are to be obtained now. A new formula has to be defined to include the low NOx range and validated.**

**Moreover formula was developed for on/off boilers, and not for modulating boilers and for different burner types.**

### **2.4 Proposal**

**We recommend that the Chairman of CEN/TC 238 writes a letter to LABNET requesting a proposal for pre-normative research so as to provide an answer to the above mentioned question, to amend and extend the value of the formula given in CR 1404 (Annex 1, p. 25) and also mentioned as #12 in Annex 1 of the GLP.**

## ■ CEN/TC 238/WG 2 draft proposal for a mandate (1/2)

Aim : to develop a standard

The standard produced shall lay down **procedures and methods of measuring emissions (esp. NOx and CO)**.

A methodology for measurements of emissions of gas appliances covered by the GAD, including definition of details and uncertainty of the measurements used, for gas appliances except gas cookers and flueless appliances.

Specify test conditions for measuring the combustion products composition (CO, CO<sub>2</sub>, O<sub>2</sub>, NOx), the test methods being defined in the particular EN appliance standards.

NOx level is closely linearly linked to the adiabatic temperature which depends on gas nature, air temperature, humidity and excess air (CO<sub>2</sub> in the combustion products).

But CO<sub>2</sub> concentration depends on boiler technology.

Below 50 mg/KWh, a general tendency is that more scientific parameters are to be used:

Adiabatic flame temperature,

Oxygen concentration in the combustion products,

Gas quality.

Present technologies include air/fuel ratio controls, limited air excess, often room sealed.

**Proposal** : to **test several** (more than two) **boilers with low emissions (below 100 mg/KWh)**, **focusing on the physical and chemical parameters that influence the correction**, on top of the ones already listed and measured (air temperature, humidity, gas quality).

## ■ CEN/TC 238/WG 2 draft proposal for a mandate (2/2)

The mandate should include two phases :

1) **Pre-normative research** including:

**Theoretical investigation to identify relevant factors** influencing NOx and CO emissions,

**Round Robin tests** for validation of the proposed calculation(s):

- Definition of test program
- Actual tests

Conclusion of Phase 1

2) Taking into account the results of Phase 1 **to draft an EN standard (revising the content of CR 1404:1994)** that the appliance standards will refer to.

Duration of both phases is to be defined in the mandate.

## ■ Report of WG 2 to plenary of CEN/TC 238

Since last plenary meeting of CEN/TC 238 on 2009-09-24, CEN/TC 238/WG 2 met on 2009-11-10.

Report of this meeting is Document CEN/TC 238/WG 2/N6, which sums up the **complexity of the issue** and the **need for pre-normative research**.

A further meeting was initially scheduled for 2010-02-16 ; it was cancelled due to shift in priorities for Labnet members, linked to the acknowledgement of the European Commission of the problem of NOx.

The proposal from WG 2 Convenor is that CEN/TC 238 acknowledges that the **task be put on hold until laboratories agree on a proposal**. **Financing of the pre-normative research** might be sought directly through gas industry research programs rather than through a EC funded mandate which would also require significant administrative costs.