



## MHA Technical Committee Action Plan 2015-2016

### Context

The EPA is expecting 3 things from MHA :

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The EPA is not finalizing, at this time, the proposed Standards of Performance for New Residential Masonry Heaters in order to allow additional time for the Masonry Heater Association to finish their efforts to develop revised test methods, an emissions calculation program and an alternative dimensioning standard.

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After we receive additional information from MHA and others, we will consider if we should take final action for new residential masonry heaters in a future rulemaking.

### Goals

1/ Verification of key variables

a) Mass flow rate

It's the mass of the flue gasses (in mg) flowing through a heat exchanger and chimney every second. This is the basic parameter that affects all other variables.

Once it is known, these variables can be accurately calculated :

- velocity of flue gasses through the system
- temperatures and pressure values
- heat transfer rates
- pressure losses due to changes in direction
- pressure losses due to changes in velocity

It is then possible to :

- create heat transfer formulas for flue gasses moving in various directions
- determine the specific factors for changes in direction

But mass flow rate cannot be measured directly. It must be estimated indirectly by combining the measurements of :

- atmospheric pressure
- ambient air temperature
- air intake velocity
- air moisture content at the point entry of the appliance
- carbon monoxide and oxygen
- water vapour content of flue gasses

Reliable estimation of mass flow rate requires measurements of these variables to be as accurate as possible. This is done by selecting the measuring devices that offer a high accuracy and a low margin of error and by following manufacturer's instructions. Using instruments with lesser accuracy could lead to wide margins of error in calculations of mass flow rate as the uncertainties in measurements compound.

#### b) Temperatures in firebox and heat exchanger entry point

They are estimated to 700C and 550C respectively in EN15544. These values need to be measured during a series of low emissions tests and averaged.

### 2/ Correlation of dimensioning and emissions

An empirical correlation between proper function of the appliance and emission levels must be determined. The key factor is the air factor (total air / stoichiometric air).

Proper function is determined by the dimensioning standard as the combination of :

- balanced ascensional forces and resistances while maintaining the air factor in the optimum range for complete combustion
- a minimal efficiency rate (which needs to be determined)

The emission limit is set by the EPA based on the Best Systems of Emission Reduction, the costs for the industry to adopt the current BSER and the projected impact on public health.

### 3/ Test methods

If lb/MMBtu is chosen as the emissions format, a method to measure efficiency is required.

We propose to use the Condar stack loss method and will describe it.

A testing protocol will be written, including :

- a fuelling protocol
- start of measurement
- end of measurement (adopting the European 75% O2 recovery method will be investigated)
- permitted operator intervention, ash removal...

## **Action Plan**

### 1/ Outline

#### a) Build a test heater in Norbert's workshop

- as per Damien's specifications
- a very simple design first (long air intake conduit, updrafting channel, downdrafting channel, horizontal channel)
- heat exchanger will be turned into a contraflow, then into a bell; a bench and other appendices can be added
- bricks & hardware supplied by Norbert, construction by MHA members

#### b) Acquire additional testing equipment

- additional equipment to be acquired as per Damien's specifications
- installation of equipment and data acquisition system by Norbert and other tech com. members; probes positioned as per Damien's instructions

#### c) Run a series of tests

- follow testing protocol designed by tech comm.
- start with 20 to 30 tests until mass flow rate is accurately estimated
- collected data to be used for further calculations
- firewood supplied by Norbert
- tests administered by Norbert's shop technician and tech com. members

#### d) Support the creation of a test lab for the french MHA (AFPMA)

- MHA will help with the purchase of the equipment
- AFPMA will run similar tests as MHA
- AFPMA's goal is update the dimensioning standard for handbuilt heaters currently in effect in France (EN15544)
- this will show MHA's appreciation of Damien's contribution

### 2/ Budget

- materials for the test heater	\$3,000	
- equipment	\$5,500	
High temperature O2 sensor		\$1100
High accuracy hot wire anemometer		\$2200
Testo 330 CO cell replacement		\$500
Hygrometer, barometer, supplies		\$300
Data acquisition (console, software, probes)		\$1400
- technician time		
40 tests x 3 hours per test x \$25	\$3,000	
- contribution to AFPMA	\$3,500	
Total budget	\$15,000	

### 3/ Timeframe

- test heater to be built before the end of November
- testing to start in December, at the earliest

### Further goals

1/ Convert the spreadsheet-based dimensioning program into a software application

- will improve user friendliness
- limit the risk of tampering with the program
- written in a modern programming language

2/ Write the dimensioning standard

- will be formulated from the dimensioning program
- language and presentation consistent with standards of technical documentation

3/ Certification of the dimensioning standard and program

- select and start working with an EPA-accredited lab

4/ Individual certification process

- requirements : training on proper use of the dimensioning program, contract...
- process to get an EPA certified label
- checks, cost