



<b>ATF-LS-FRL</b> <b>Sand Burner and Gas Cart - Standard Operating Procedures</b>	Published Online: <b>March 2018</b>
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Unofficial Copy; May Not Be Most Current Version	Page: 1 of 6

1) Initial Setup

a) *Supplies Required*

i) *Stainless steel braided hose for natural gas transport*

(1) Diameter from main to gas cart: 3.8 cm (1½ inch)

(2) Diameter from gas cart to burner:

(a) 2.5 cm (1 inch) for 1000 SLPM

(b) 0.64 cm (¼ inch) for 100 SLPM

(c) 5 cm (2 inch) for 3000 SLPM

ii) *Burner*

(1) Sand Burner 1: 0.41 x 0.41 m

(2) Sand Burner 2: 0.41 x 0.41 m

(3) Sand Burner 3: 0.30 x 0.30 m

(4) Sand Burner 4: 0.20 x 0.20 m

(5) Sand Burner 5: 0.71 x 0.71 m

iii) *115 VAC electrical power – single extension cord*

iv) *FireTOSS connectivity – single Ethernet cable*

v) *FireTOSS client computer*

b) *Plumbing and Electrical/Data Connections*

i) *Connect appropriate stainless steel braided hose from fuel supply to cart and cart to burner*

ii) *Perform a leak check on all connections*

iii) *Connect cart to power outlet using extension cord*

iv) *Connect cart to FireTOSS port using ethernet cable*

Note: Make sure that mass flow controllers are NOT powered ON until ready for use. Make sure mass flow controller is UNPLUGGED. This is a precautionary measure to prevent burnout.

## 2) Start-Up and Pre-Test

- a) *Check calibration of mass flow controller(s), data acquisition hardware and pressure transducer – If out of calibration, see calibration technician*
- b) *Select appropriate burner setup for test*
  - i) *For 0-50kW, use 100 SLPM gas train (Gas Train C)*
  - ii) *For 0-500 kW, use single 1000 SLPM gas train (Gas Train A, B or D)*
  - iii) *For 0-1300 kW, use 3000 SLPM gas train (Gas Train E)*
  - iv) *For 0-1500 kW, use three 1000 SLPM gas trains (Gas Trains A, B and D)*
  - v) *For 0-2800 kW, use three 1000 SLPM gas trains (Gas Trains A, B and D) and the 3000 SLPM gas train (Gas Train E)*
- c) *Position burner(s) where needed*
- d) *Set up and ignite propane pilot for Burners – Do NOT turn burner gas supply ON until pilot light has been ignited*
- e) *Plug power cord into mass flow controller*
- f) *Verify that mass flow controller set point is 0.0g*

*g) Turn natural gas ON*

*i) In mezzanine, turn gas valve to ON position, turn the compressed air valve to ON position and turn control switch to manual position*

*ii) Pull out emergency shutoff “mushroom” button located on wall of burn room*

*iii) Turn wall main valve(s) to ON position*

*iv) Turn both valves on cart(s) to ON position*

*h) Check pressures to cart(s) to verify adequate gas supply*

### 3) Experiment Procedures

*a) During Test*

*i) Monitor pressure at cart to ensure adequate fuel supply*

*ii) Monitor mass flow controller set point to verify desired flow*

*b) Burner Control Through iFix*

*i) Launch iFix*

*ii) Select “Burner Control” button at bottom of screen*

*iii) Select the gas cart(s) to be used*

*iv) Select the gas to be used (generally natural gas)*

v) *Verify combustion calorimeter warning light is green.*

vi) *Select the program to run*

- (1) Manual – User control of flow rate controlled with input box
- (2) 5 Point Cal – Burner follows a preset series of five flowrates
- (3) 8 Point Cal - Burner follows a preset series of eight flowrates
- (4) Custom – Runs a Prescribed HRR Curve From a text file
  - (a) Text file must be located in the C:\ directory and have the name “BurnerControlX” where X is the gas train name (A,B,C,D,E)
  - (b) In text file, input the following: HRR,Duration
    - (i) “HRR” is the desired Heat Release Rate of the specific step
    - (ii) “Duration” is the time duration of the specific step
    - (iii) Each line of the text file is interpreted as a “step” by the burner program. A correct text file should be formatted as such:
      1. HRR,Duration
      2. HRR,Duration
      3. HRR,Duration
      4. ...
    - (iv) Upon the completion of the final step (line of the text file), the Burner Control Program will set all active Mass Flow Controller set points to zero (0).

vii) *Start Program Selected*

- (1) If using 5 Point Cal, 8 Point Cal, or Custom, press “Gas ON” button
- (2) If using Manual program, enter starting value in input box and press “Enter” key. Subsequent values are also entered using this method.

viii) *Press “Gas OFF” button when finished test*

4) Shut-Down and Post-Test

a) Turn OFF natural gas.

i) Turn both valves on cart to OFF position

ii) Turn wall main valve to OFF position

iii) Push In emergency shutoff “mushroom” button located on wall of burn room

iv) In mezzanine, turn gas valve to OFF position, turn the compressed air valve to OFF position and turn control switch to OFF position

b) Power OFF mass flow controllers if no more tests are being performed by unplugging power cord from mass flow controller

5) Maintenance

a) Periodically check for leaks at connections

b) Power OFF mass flow controllers when not in use

6) Calibration - All instrumentation associated with the sand burner and natural gas cart shall be calibrated annually. These Instruments Include:

a) Mass flow controller

b) Pressure transducer

[TDR1]

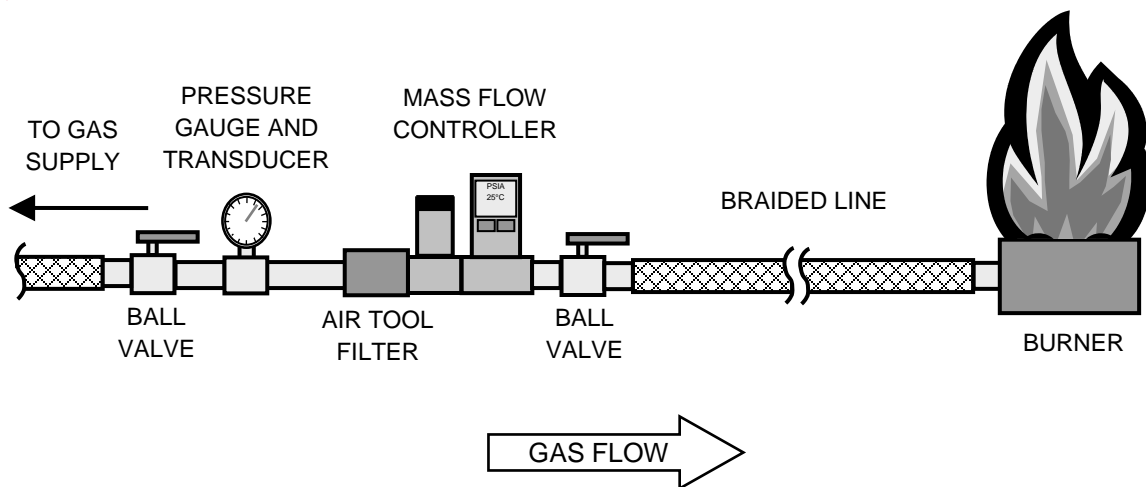


Figure 1 - Gas train diagram

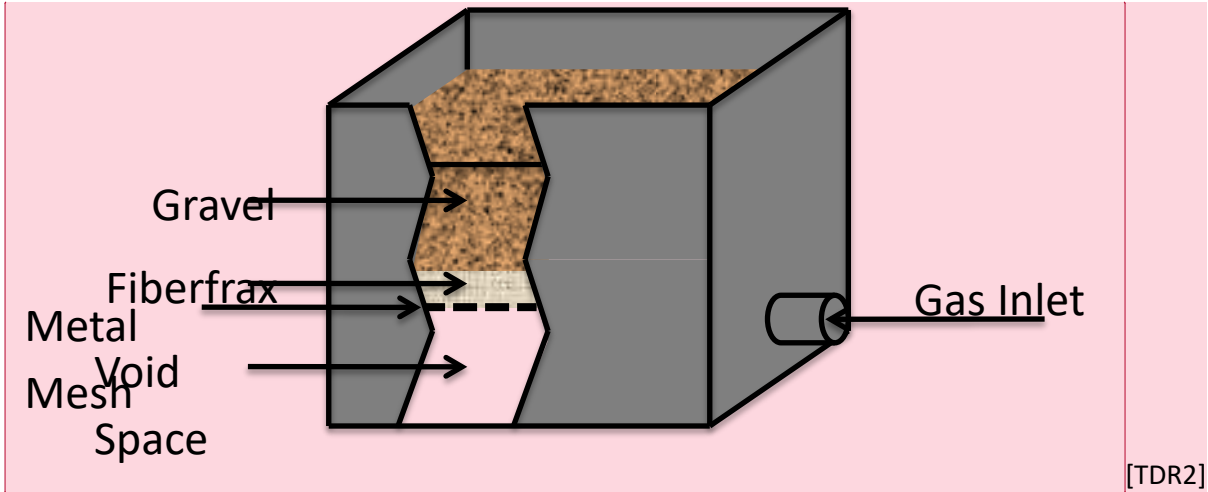


Figure 2 - Diagram of a typical sand burner