I claim:

1. An upstream mass flow verification system for testing the performance of a mass flow measurement device, the system comprising:

an upstream volume capable of storing a test fluid;

a temperature sensor to sense the temperature within the upstream volume;

a pressure sensor to sense the fluid pressure within the upstream volume; and

a processor configured to calculate the flow rate of test fluid through the mass flow controller and which compensates for errors caused by a dead volume within the mass flow controller.

2. The system of claim 1, wherein the dead volume is set to zero.

3. The system of claim 1, wherein the dead volume is entered by a user of the system.

4. The system of claim 1, wherein the flow rate is determined after the temperature has stabilized.

5. The system of claim 1, further comprising an input valve for controlling the flow of test fluid into the volume, and an output valve for controlling the flow of fluid from the volume through the mass flow measurement device, wherein the output valve is closed and input valve is opened so as to fill the volume until it reaches a measurable pressure level, and wherein the input valve is then closed, and the output valve is open to allow fluid to flow from the volume through the mass flow measurement device.

6. The system of claim 5, wherein the flow is measured according to the following:

$$Q = \frac{(V_t - V_d) \cdot T_{stp}}{R \cdot P_{stp} \cdot T} \cdot \frac{dP}{dt}$$

wherein Q is the measured flow rate,

V_t the total volume of the MFV system,

V_d represents the dead volume of the mass flow measurement/delivery device under test,

R is the universal gas constant,

P and T are the gas pressure and temperature respectively, and

P_{stp} and T_{stp} are the standard pressure (1.01325e5 Pa) and standard temperature (273.15K) respectively.

7. A method of verifying the performance of a mass flow measurement device, comprising:

establishing the level of pressure of a test fluid in a fixed volume;

opening a valve to transfer the test fluid from the volume through a test mass flow measurement device;

determining the mass flow rate through the mass flow measurement device as a function of the temperature of the test fluid and the rate of change in pressure of the test fluid from the established level, wherein the calculation compensates for errors caused by a dead volume within the mass flow delivery/measurement device under test.

8. The method of claim 6, further comprising entering a value of the dead volume received from the manufacturer of the mass flow delivery/measurement device.

9. The method of claim 7, wherein the entered value is zero.

10. The method of claim 6, wherein the flow rate is calculated after the temperature has stabilized.

11. The method of claim 6, wherein determining the mass flow rate includes wherein measuring the flow according to the following:

$$Q = \frac{(V_t - V_d) \cdot T_{stp}}{R \cdot P_{stp} \cdot T} \cdot \frac{dP}{dt}$$

wherein Q is the measured flow rate,

V_t is the total volume of the MFV system,

V_d represents the dead volume of the mass flow measurement/delivery device under test,

R is the universal gas constant,

P and T are the gas pressure and temperature respectively, and

P_{stp} and T_{stp} are the standard pressure (1.01325e5 Pa) and standard temperature (273.15K) respectively.

I claim:

1. An upstream mass flow verification system for testing the performance of a mass flow controller, the system comprising:

an upstream volume capable of storing a test fluid, wherein the upstream volume is upstream of a mass flow controller, wherein the mass flow controller is under test and has a given dead volume;

a temperature sensor configured to sense the temperature within the upstream volume;

a pressure sensor configured to sense the fluid pressure within the upstream volume; and

a processor configured to receive temperature and pressure signals from the temperate sensor and pressure sensors, respectively, and to calculate the flow rate of test fluid through the mass flow controller based on the received temperature and pressure signals and which compensates for errors caused by the given dead volume within the mass controller;

wherein the processor is configured to, in calculating the flow rate of test fluid through the mass flow controller, compensate for the given dead volume for either of (i) the case where the mass flow controller is pressure-insensitive, or (ii) the case where the mass flow controller is pressure-sensitive.

2. The system of claim 1, wherein the dead volume is set to zero by the processor.

3. The system of claim 1, wherein the dead volume is entered by a user of the system.

4. The system of claim 1, wherein the flow rate is determined after the temperature has stabilized.

5. The system of claim 1, further comprising an input valve for controlling the flow of test fluid into the volume, and an output valve for controlling the flow of fluid from the volume through the mass flow controller, wherein the output valve is closed and input valve is opened so as to fill the volume until it reaches a measurable

pressure level, and wherein the input valve is then closed, and the output valve is open to allow fluid to flow from the volume through the mass flow controller.

6. The system of claim 5, wherein the flow is measured according to the following:

$$Q = \frac{(V_t - V_d) \cdot T_{stp}}{R \cdot P_{stp} \cdot T} \cdot \frac{d(P/T)}{dt}$$

wherein Q is the measured flow rate,

V_t the total volume of the mass flow verification (MFV) system,

V_d represents the dead volume of the mass flow controller under test,

R is the universal gas constant,

P and T are the gas pressure and temperature respectively, and

P_{stp} and T_{stp} are the standard pressure (1.01325e5 Pa) and standard temperature (273.15K) respectively.

7. A method of verifying the performance of a mass flow measurement device, comprising:

establishing the level of pressure of a test fluid in a fixed volume;

opening a valve to transfer the test fluid from the volume through a test mass flow measurement device under test having a given dead volume;

determining a calculation of a mass flow rate through the mass flow measurement device as a function of the temperature of the test fluid and the rate of change in pressure of the test fluid from the established level, wherein the calculation compensates for errors caused by a given dead volume within the mass flow measurement device under test;

wherein the processor is configured to, in calculating the flow rate of test fluid through the mass flow measurement device, compensate for the given dead volume for either of (i) the case where the mass flow measurement device is pressure-insensitive, or (ii) the case where the mass flow measurement device is pressure-sensitive.

8. The method of claim 7, further comprising entering a value of the given dead volume received from the manufacturer of the mass flow measurement device under test.

9. The method of claim 8, wherein the entered value is zero.

10. The method of claim 7, wherein the flow rate is calculated after the temperature has stabilized.

11. The method of claim 7, wherein determining the calculation of the mass flow rate includes calculating the flow according to the following:

$$Q = \frac{(V_t - V_d) \cdot T_{stp}}{R \cdot P_{stp} \cdot T} \cdot \frac{d(P/T)}{dt}$$

wherein Q is the measured flow rate,

V_t is the total volume of the MFV system,

V_d represents the given dead volume of the mass flow measurement device under test,

R is the universal gas constant,

P and T are the gas pressure and temperature respectively, and

P_{stp} and T_{stp} are the standard pressure (1.01325e5 Pa) and standard temperature (273.15K) respectively.