Development of a New TEOM® Dichotomous Continuous Particulate Matter Monitor

November 8, 2006

Thermo
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Stage-Gate® Framework

The Idea-to-Launch Roadmap for Product Development

How Thermo Air Quality Instruments Brings New Ideas to the Marketplace

Analyze • Detect • Measure • Control™

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Using A Process For Product Development

IDEA

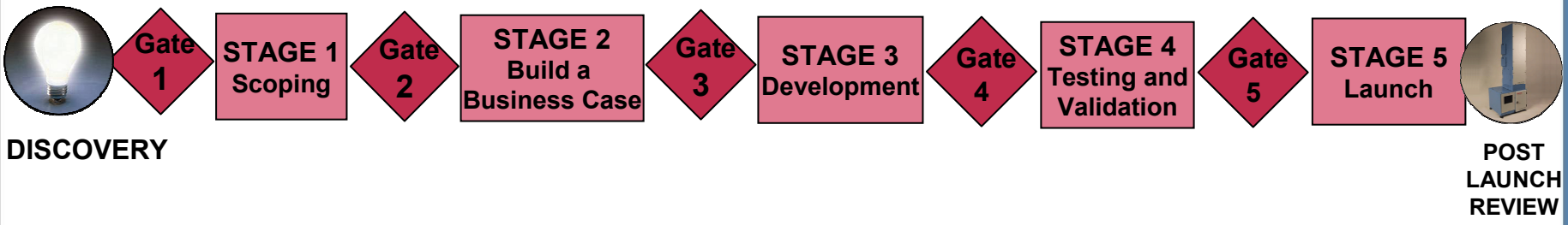
New Product Process

SUCCESSFUL PRODUCT

- Efficiently transform product ideas into quality products
  - *The process*
    - Improves understanding of customers needs
    - Provides a rugged field tested product
    - Ensures product delivery goals are met
    - Provides a quality product that is easy to produce and service

Process helps ensure quality product

5-Stage Product Innovation Process



- Provides rigor and structure for the development of new products and services
- Allows greater risk management and management of resources
- Gates provide quality control check points that ensure quality product

1405-DF Development Summary

- Jun 2003: New Nafion Dryer R&D Begins
- Dec 2003: Initiate Commercialization Process for Dual TE System
- Apr 2005: Five Working Prototypes Completed and Field Tested
- Dec 2005: Electronics Redesign, Hardware Redesign
- Jan 2006: Series 8500C Development Begins → **Using Common 1405 Components**
- Feb 2006: Two Alpha Units Built and Tested
- May 2006: 17 Beta Units Built by EGB Production Dept.
- Aug 2006 Beta Tests begin – Birmingham, AL and Queens, NY

Development ongoing for 3+ years

FDMS Series 8500C Development Summary

- Modular components developed for the 1405 DF were incorporated into the FDMS for commonality
  - *Dryers*
  - *47mm filter conditioners*
  - *Switching Valve*
- Series 8500C Development Summary
  - *Apr 2006* — *Beta test units tested in Bakersfield, CA*
  - *Jun 2006* — *Production release*
  - *Aug 2006* — *Product launch*
  - *Sept 2006* — *Ship*

TEOM Series 1405 Platform
“Dichot TEOM Monitor”

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Filter Dynamics Measurement System

Series 8500 FDMS System → Series 1405-DF TEOM Monitor

The switching valve alternates the flow through the sensor unit between the sample (base) and purge (reference) flows every six minutes.

Base mass *is Total PM + Δ*

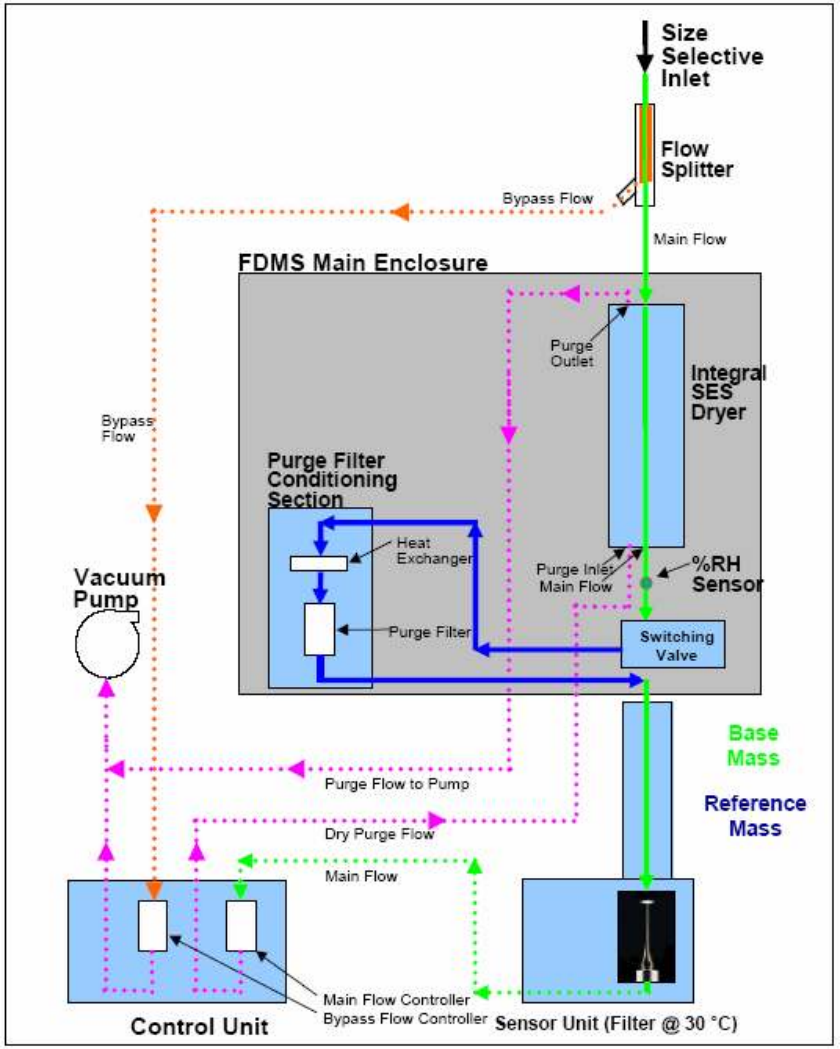
Reference mass *is Δ only*

Total PM = Base Mass – Reference Mass

PM_{10} or $PM_{2.5}$

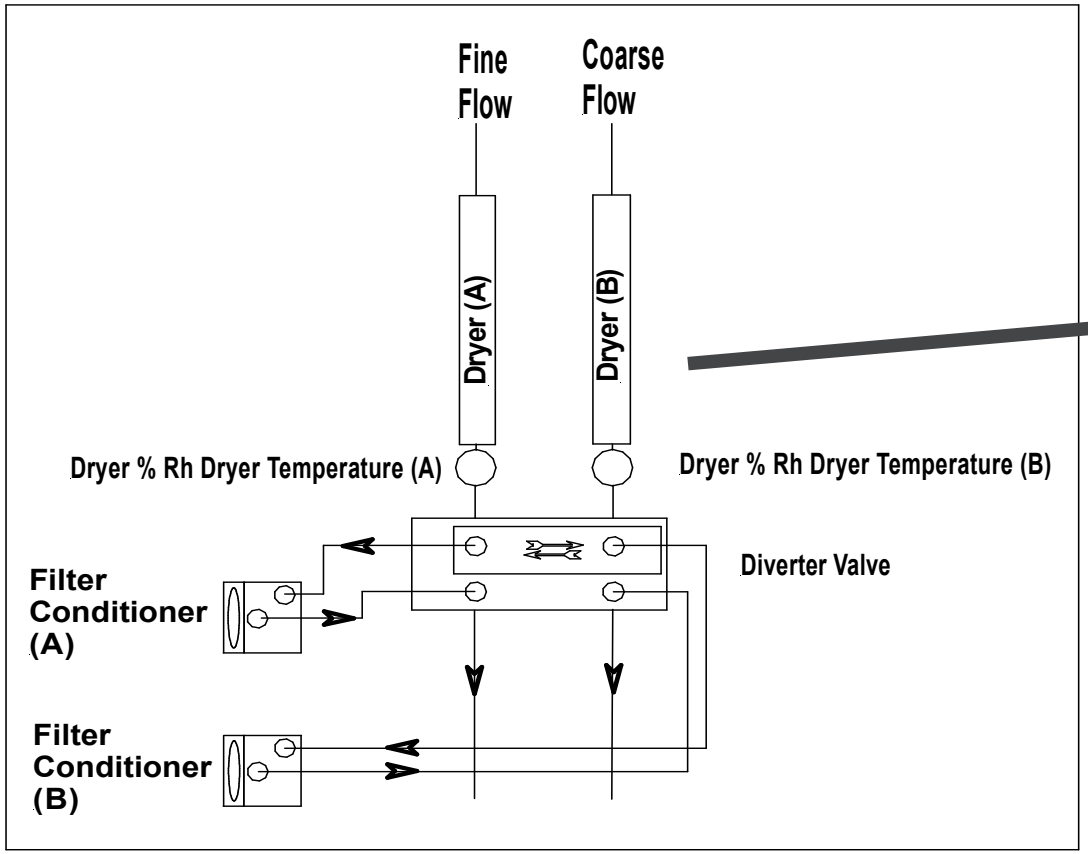
x 2

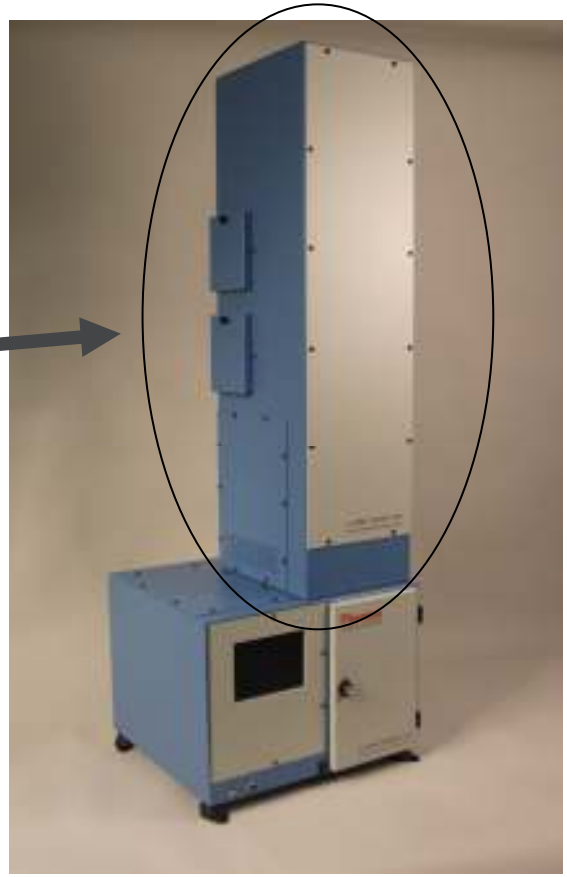
$PM_{2.5}$ *and* PM_c (*and* PM_{10})



FDMS Technology

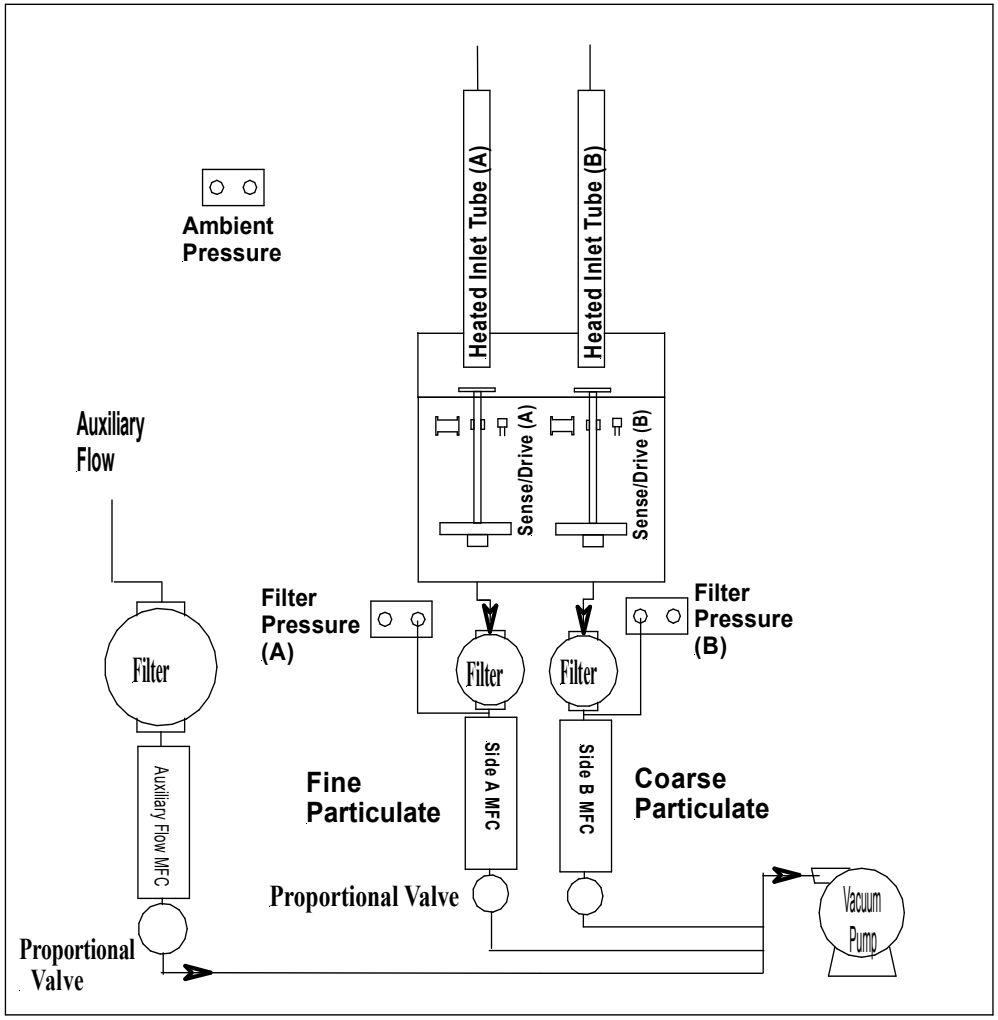
1405-DF FDMS Schematic



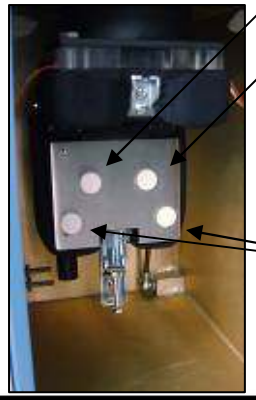


FDMS Components

1405-DF Schematic



1405 Components



Fine Filter (PM-2.5)

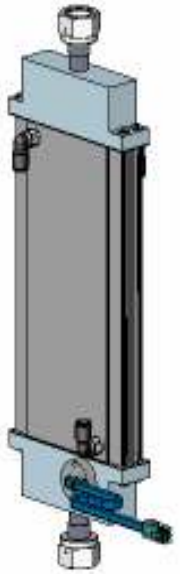
Coarse Filter (PM between 2.5 and 10 µm diameter)

Storage of extra sample filters

Ambient Particulate
Series 1405 – TEOM Monitor

Innovative new dryer

- Higher drying efficiency
- Negligible PM loss
- Patented Technology
- Potential crossover opportunities with other Air Quality Products



1405 DF Features

- ¼ VGA touch screen graphical user interface
- SQL database
  - *Unlimited number of variables*
  - *Capacity of over 1,000,000 records*
  - *Stores system diagnostics*
- USB data download
  - *Download historical instrument data onto a USB drive*
- Calibration and Maintenance Wizards
  - *Walks the user through the calibration and maintenance procedures*
- Networking capabilities
  - *Instruments can be networked and accessed remotely through Ethernet using rpCommunicator*

1405-DF Timetable

- Nov 2006 Complete Beta Tests
- Nov 2006 Develop plans for Class III FEM testing
- Feb 2007 Conduct 6-Unit Production Test Run
- Feb 2007 Product Launch (Orders / Production)
- Apr 2007 Shipments begin

Frequently asked Questions

- when will Series 1405 DF units be available?
  - *Limited quantities beginning March 2007*
- how much does a 1405 DF cost ?
  - *Stop by the Thermo booth and request a quote*
- what are Thermo's plans for equivalency?
  - *Thermo intends to obtain Class III equivalency*
  - *Stop by the Thermo booth and request a quote*