Introduction

In this Section:

- *A brief history of Auto-Matrix and Auto-Flow in the Laboratory and Clean Room Airflow Control Market*
- *Objectives of the Auto-Flow Engineering Manual*
- *Brief descriptions of each section included in this Manual*

Auto-Flow Background

In 1988, Auto-Matrix began development of specialized products for laboratory and fume hood airflow control applications. Initially designed to serve the needs of existing Auto-Matrix system installations, these products focused on speed, accuracy, and networkability. As a result of the success of the initial system installations, Auto-Matrix has continued to develop and refine these products to meet the demanding requirements of laboratory and fume hood operations. In order to reaffirm our long-term commitment to this market segment and better serve the expanding market for variable air volume (VAV) fume hood and laboratory controls, Auto-Matrix has announced the creation of the Auto-Flow division. The Auto-Flow system deals exclusively in the specialty airflow control applications related to fume hoods, laboratories, and clean rooms. Auto-Flow has patented unique features in its fume hood control product and has arranged for the exclusive distribution of related sensing and actuation products. The combination of these components comprises the Auto-Flow system and constitutes a truly unique offering to the marketplace.

Demanding Needs Of Fume Control Applications

Laboratory operations involving toxic or hazardous materials are usually conducted within a fume hood. The objective of a fume hood in laboratory operations is to keep fugitive emissions from the process from reaching the operator or other occupants of the laboratory. Containment of contaminants within the hood is accomplished by controlling the velocity of the air entering the hood face, referred to as the fume hood face velocity. In VAV fume hood systems, as the fume hood operator raises or lowers the fume hood sash, the control system modulates the fume hood exhaust damper to maintain the face velocity at a typical setpoint of 100 FPM. Too low a face velocity may not be sufficient to overcome competing airflow caused by operator movements or the laboratory air distribution system and could result in an exposure to the operator. Too high a face velocity causes turbulent air patterns, forcing airborne hazards out of the fume hood into the operator's breathing zone. The time required to return the face velocity to setpoint after change of sash position is known as the system recovery time. Establishing the optimum value of this property is critical to effective fume hood containment.

Auto-Flow Satisfies the Control Requirements

The first step in providing effective control of the fume hood face velocity is its accurate measurement. The Auto-Flow system is the only system that measures the actual fume hood face velocity in the plane of the sash. The face velocity is measured with a patented airfoil pitot tube and ultra low range slack membrane pressure transducer. The brains of the fume hood control system is the fume hood monitor and controller. The high performance Auto-Flow fume hood controller reads this face velocity input, performs a Proportional + Integral + Derivative (PID) calculation, and updates the output signal 20 times every second. High-speed actuation and control are achieved through the Auto-Flow electronic actuator and precision damper assembly. The result of the integration of the patented and unique features of each of these individual components is a total fume hood control solution that provides effective fume hood containment through face velocity recovery of 1 second or less.

Introduction

AUTO-FLOW®

Control of the Laboratory

Control of the fume hood is only part of the story. For any VAV fume hood system to be effective, the laboratory environment must also be controlled. Typically the laboratory space is controlled to a negative pressure relative to the adjacent spaces to prevent the migration of fumes from the laboratory. In clean room applications, a positive pressure is maintained relative to the adjacent spaces to prevent contaminants from migrating into the space. Because the operation of the fume hood dynamically affects the pressurization of the laboratory, the Auto-Flow system provides an integrated solution to control both. Space pressurization is accomplished through a combination of ultra low space pressure sensing technology and high-speed control and actuation. In addition to space pressurization control, the Auto-Flow system also integrates laboratory space temperature and humidity control.

Non safety Related Benefits of the System

Dramatic reductions in operating costs are realized through optimized variable air volume (VAV) control of fume hoods and laboratory systems compared to constant volume systems. Due to the ultra low space pressure sensing technology of the Auto-Flow system, smaller space pressure differentials can be maintained, resulting in additional cost reductions over competitive systems. Additionally, since the system utilizes all electronic actuation, the high maintenance costs associated with pneumatic systems are eliminated.

The Auto-Flow system also provides the benefits of direct digital control (DDC) to satisfy the comfort requirements of the occupants and the environmental control constraints of laboratory operations through precise temperature and humidity control.

Through its inherent networking capabilities, the Auto-Flow system can be a valuable tool in complying with the requirements of regulatory agencies through centralized access to system performance, custom report generation, and historical trending of information.

Bringing the Technology to Market

Auto-Flow provides comprehensive engineering support and training to the people that sell and install Auto-Flow systems. Several levels of Auto-Flow system certification are available through the four-day training workshops provided at our facility. This training ensures that our standards for quality systems and services are extended to all end-users of Auto-Flow systems, and that each system perpetuates our reputation for providing quality.

Auto-Flow systems are sold through a network of independent specialty manufacturer's sales representatives. These representatives have the specialized laboratory expertise to provide engineering and design assistance to mechanical consultants and end-users of Auto-Flow systems. Start-up, commissioning, and after-installation service of Auto-Flow systems are typically performed by local Auto-Matrix dealers who have been certified in the start-up and commissioning of Auto-Flow systems. The local installation and service expertise provided by these Auto-Matrix dealers are a key asset to the long-term needs of Auto-Flow customers.

Integrating the Auto-Flow System into Auto-Matrix Systems

One of the key strengths of the Auto-Flow system is the ability to seamlessly integrate it into an Auto-Matrix building automation system. If a customer's needs extend beyond control of the laboratory spaces and fume hood, our network of Auto-Matrix dealers can integrate the advanced networking, trending, and report generation capabilities of field panels and SPECTRA color graphics into the Auto-Flow system. Additionally, the Auto-Matrix dealer can provide a complete system solution for integration of the building's central mechanical systems and automation of all of the non-laboratory areas of the facility. Through the integration of these systems and resources, Auto-Flow is uniquely positioned to provide effective solutions to the short-term and long-term needs of our customers.

Objective

The objective of this manual is to provide a basic understanding of:

- the function of various airflow and pressurization-related equipment found in laboratories and clean rooms
- current technologies used to control airflow, face velocity, and pressurization and how they compare to the Auto-Flow methodology
- the basic goals in laboratory control
- the current standards and guidelines which regulate these goals
- selection of the proper Auto-Flow components and services required for any particular project
- the needs of the laboratory airflow control market and the typical approaches to achieving the desired results

Sections of this Manual

Section 3: Major Mechanical Components Related to Airflow

This section identifies and describes various mechanical components found in a typical laboratory or clean room which are directly related to the regulation and distribution of the airflow in and around the laboratory and fume hood.

Section 4: Measurement Methodology

This section identifies and describes the various sensors, transducers and instruments typically used to measure airflow, space pressure and fume hood face velocity in laboratories and clean rooms.

Section 5: Methods of Airflow Regulation

This section identifies and describes the various devices used to regulate the amount of airflow in a duct or hood and the typical instruments and actuators used to operate them.

Section 6: Laboratory Airflow Control Methodology

This section identifies and describes the various methods applied to controlling airflow, face velocity and space pressure in typical laboratories, clean rooms and hoods.

Section 7: Auto-Flow System Components

This section identifies and describes each of the individual components which make up the Auto-Flow System and also describes how to select the proper component and part number for each device.

Section 8: Standard Applications

This section identifies and describes each of the individual standard Auto-Flow applications.

Section 9: Detail Drawings

This section consists of the detail drawings associated with the component systems that make up the standard applications.

Section 10: Laboratory Regulations, Standards, and Guidelines

A collection of excerpts from many of the applicable laboratory standards and guidelines comprising information pertinent to the laboratory and fume hood velocity, flow, and pressure control.

Section 11: Guide Specification

A sample guide specification centered on the Auto-Flow system as basis of design.

Section 12 Energy Savings Calculations

Sample calculations of expected energy savings of VAV vs CAV hood systems with various sash usage scenarios.

AUTO-FLOW

Experience

Auto-Flow systems have faithfully served the needs of many different types of laboratory facilities. The following list provides a sample of customers being served by Auto-Flow systems.

- **Abbott Laboratories**
- **Ross Laboratories**
- **NASA-Lewis Research Facility**
- **Underwriters Laboratories**
- **CIBA-Vision**
- **A. H. Robbins**
- **Rockefeller Center**
- **Centers for Disease Control**
- **University of Minnesota**
- **Hong Kong University of Science and Technology**
- **Rochester Institute of Technology**
- **Novi High School**
- **Occidental Chemical Corporation**
- **CIBA-Geigy**
- **Carnegie Mellon University**
- **OSHA Oregon**
- **Eli Lilly**

AUTO-FLOW

Training and Engineering Support

Auto-Flow is committed to providing unparalleled service and support to the users of our systems. Auto-Flow systems are distributed by an international network of specialty manufacturer's sales representatives. These representatives complement the Auto-Flow products by providing local expertise and engineering support. In addition, local service, installation and commissioning of Auto-Flow systems is provided by a network of factory-certified service contractors.

While the focus at Auto-Flow is clearly set on the continued development of technology that sets new standards for laboratory safety, efficiency and comfort, we realize that our products are only as good as the organizations who apply them. To satisfy our commitment to total service, Auto-Flow offers a comprehensive certification training program for the people that sell, engineer and commission Auto-Flow systems. The individual certification programs are conducted at our full-scale laboratory training facility in Export, Pennsylvania. The training laboratory includes seven different fume hood types and manufacturers in two separate pressurized laboratory environments.

In addition to our training programs, Auto-Flow supports our network of representatives and service contractors through a dedicated customer service group. Our team of telephone technicians is equipped to address a wide range of questions from installation, start-up, system configuration and operation.

The Engineering Services (ES) Group is a separate group within Auto-Flow whose charter is to provide comprehensive engineering services to complement the capabilities of our distribution network. ES provides a full range of engineering services, from conceptual system design and budgeting, to on-site installation supervision and commissioning assistance.

Auto-Flow is dedicated to providing the innovative systems and comprehensive support services to ensure that each one of our systems perpetuate our reputation for providing the highest quality systems.