



Comparison of Laboratory Control Systems Testing Results

Course Number: CXENERGY1934

Gaylon Richardson Engineered Air Balance Co., Inc.



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Course Description

This presentation will identify key differences between various laboratory control systems. The test include: Static Tests: Differential pressure tests at constant volume and airflow accuracy at different static pressures and volumes. Twelve dynamic tests were conducted to evaluate supply and exhaust tracking capabilities.



Learning Objectives

At the end of the this course, participants will be able to:

1. Understand key differences between commonly used laboratory control systems.

2. Describe how static, dynamic, and differential pressure tests are conducted.

3. Understand how different status pressures and volumes affect testing.

4. Explain how dynamic tests permits evaluation of supply and exhaust tracking capability.



Laboratory Control Systems

This report summarizes testing of 6 different laboratory control systems of the 12 tested using setpoint and offset control. Engineered Air Balance Co. was contacted by an owner and two different engineering firms to develop a test that would compare all the different laboratory control system companies for their evaluation and determination if the specifications would be met.

To simplify this report covers six different sy	ystems that were tested:
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Valve Type and Number	Attributes
Venturi 1	Mechanical Airflow Control
Venturi 2	Mechanical / Digital Airflow Control
Venturi 3	Mechanical Airflow Control
Venturi 4	Mechanical Airflow Control
Blade Damper	Butterfly Damper / Digital Airflow Control
Blade Damper	Airfoil Split Damper / Digital Airflow Control



Laboratory Control Systems Using Offset Control Testing Protocols

- 1. Static Pressure Performance
- 2. Airflow Accuracy With Variable Static Pressures
- 3. Dynamic Testing Thermal Demand Override to Heating
- 4. Dynamic Testing Hood Sash Change in Heating Mode
- 5. Dynamic Testing Thermal Demand Override to Cooling
- 6. Dynamic Testing Hood Sash Change in Cooling Mode
- 7. Dynamic Testing Thermal Demand Override to Heating With Hood Sash Full Open
- 8. Dynamic Testing Exhaust System Failure With Setpoint Control
- 9. Dynamic Testing Exhaust System Failure With Offset Control
- 10. Dynamic Testing Supply System Failure With Setpoint Control
- 11. Dynamic Testing Supply Fan Failure With Offset Control
- 12. Unoccupied Mode and Occupancy Override
- 13. Dynamic Test Change Hood Face Velocity Setpoint
- 14. Dynamic Testing Terminal Valve Power Failure



			Ventu	ıri Valve 1	System-	
1		C	Control Valv	e Static P	ressure Performance	
	3 D	iameters o	of Straight I	Duct Ente	ring and Leaving Each Va	lve
	Terminal Valve	Valve ∆P	Actual ΔP	Duct SP	Airflow Set Point	Actual Airflow
	Supply	1.50	1.52	1.62	800	759
1 A	General Exhaust	1.50	1.52	2.26	800	746
	Hood Exhaust	1.50	1.48	2.15	800	707
	Supply	1.50	1.54	1.82	1300	1230
1 B	General Exhaust	1.50	1.49	3.54	1300	1229
	Hood Exhaust	1.50	1.49	3.21	1300	1171
All pr	essures in inch	es WC, all a			uct static pressure (SP) ta	ken in the main duct

entering the valve for all test



1A & 1B Test







1 C & D Inlet Connected 90° Directly Off a Plenum Tap and Discharge Has 3 Diameters of Straight Duct Leaving Each Valve

			enaight				
	Terminal Valve	Valve ∆P	Actual ∆P	Duct SP	Airflow Set Point	Actual Airflow	Fitting SP Increase
	Supply	1.50	1.56	1.94	800	762	0.32
1C	General Exhaust	1.50	1.52	2.49	800	728	0.23
	Supply	1.50	1.48	2.35	1300	1231	0.53
1D	General Exhaust	1.50	1.51	3.97	1300	1198	0.43

1 E & F Discharge Connected 90° Directly Into a Plenum Tap and 3 Diameters of Straight Duct Entering Each Valve

	Terminal Valve	Valve ∆P	Actual ΔP	Duct SP	Airflow Set Point	Actual Airflow	Fitting SP Increase
	Supply	1.50	1.48	1.96	800	754	0.34
1E	General Exhaust	1.50	1.52	2.56	800	739	0.30
	Supply	1.50	1.51	2.75	1300	1232	0.93
1F	General Exhaust	1.50	1.48	4.33	1300	1222	0.79



















	1 G & H Inlet Connected 90° Directly Off a Plenum Tap and Discharge Connected 90° Directly Into a Plenum Tap											
	Terminal	Valve	Actual		Airflow Set	Actual	Fitting SP					
	Valve	ΔP	ΔP	SP	Point	Airflow	Increase					
	Supply	1.50	1.48	1.70	800	751	0.08					
1G	General Exhaust	1.50	1.52	2.23	800	734	-0.03					
	Supply	1.50	1.52	2.22	1300	1239	0.40					
1H	General Exhaust	1.50	1.48	3.69	1300	1208	0.15					
			of Strai	aht Du	us elbow and ct Leaving	Valve						
	Terminal	Valve	Actual	Duct S	SP Airflow Se	et Actual	Fitting SP					
	Valve	ΔP	ΔP		Point	Airflow	Increase					
	Supply	1.50	1.52	1.63	800	753	0.01					
11	General Exhaust	1.50	1.47	2.31	800	748	0.05					
	Supply	1.50	1.53	1.77	1300	1244	-0.05					
1J	General Exhaust	1.50	1.53	3.80	1300	1220	0.26					



1G & 1H Test







11 & 1J Test







Inlet Connected 90° Directly Off a Plenum Tap and Discharge Has 3 Diameters of Straight Duct Leaving Each Valve

	Terminal Valve	Valve ∆P	Actual ∆P	Duct SP	Airflow Set Point	Actual Airflow	Fitting SP Increase							
	Supply	1.50	1.48	1.55	800	754	-0.07							
1K	General Exhaust	1.50	1.53	2.21	800	800 733								
	Supply	1.50	1.53	1.75	1300	1225	-0.07							
1L	General Exhaust	1.50	1.53	3.40	1300 1209		-0.14							
All pre	ssures in incl	hes WC, a	all airflow ir	ר CFM ar	nd duct static pr	ressure (SP) taken	in the							
main d	luct entering	the valve												
	Bot	th Inlet an	d Discharç	je conne	cted to a short	Radius Elbow								
	Terminal Valve	Valve ∆P	Actual ∆P	Duct SI	P Airflow Se Point	et Actual Airflow	Fitting SP Increase							
	Supply	1.50	1.51	1.55	800	752	-0.09							
1M	General Exhaust	1.50	1.50	2.21	800	737	0.00							
	Supply	1 50	1 52	1 75	1300	1232	-0.07							

Supply 1.50 1.52 1.75 1300 1232 -0.07 1N General 1.50 1.51 1300 1202 0.42 3.40 Exhaust

All pressures in inches WC, all airflow in CFM and duct static pressure (SP) taken in the main duct entering the valve









1M & 1N Test







2. Airflow Accuracy With Variable Static Pressure

The terminal control valves will be tested for pressure independence and the ability to maintain airflow setpoint across a range of operating static pressures. The valves must maintain the airflow setpoint within 1.5 seconds of the change in static pressure. The test will be conducted at 800 CFM respectively at each system static pressure.

With the terminal control valves installed with three diameters of straight duct entering and leaving the valves, adjust each fan system static pressure to achieve the minimum operating valve differential pressure at an 800 CFM airflow setpoint for each valve.

	Terminal	Initial	Final Duct	Initial	Final Valve	Initial BAS	Final BAS	Airflow
	Valve	Duct SP	SP	Valve ΔP	ΔΡ	Airflow	Airflow	Setpoint
	Supply	0.00	0.71	0.00	0.60	0	746	800
2A	General Exhaust	0.00	1.42	0.00	0.60	0	729	800
	Hood Exhaust	0.00	1.37	0.00	0.60	0	774	800
1	Supply	0.71	1.71	0.60	1.61	746	751	800
2B	General Exhaust	1.42	2.42	0.60	1.57	729	735	800
	Hood Exhaust	1.37	2.37	0.60	1.61	774	771	800
	Supply	1.71	2.71	1.61	2.59	751	776	800
2C	General Exhaust	2.42	3.42	1.57	2.50	735	759	800 _{47,0}
	Hood Exhaust	2.37	3.37	1.61	2.56	771	793	80,000

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	Terminal Valve	Initial Duct SP	Final Duct SP	Initial Valve ΔP	Final Valve ΔP	Initial BAS Airflow	Final BAS Airflow	Airflow Setpoint
	Supply	2.71	3.71	2.59	3.61	776	767	800
2D	General Exhaust	3.42	4.42	2.50	3.55	759	755	800
	Hood Exhaust	3.37	4.37	2.56	3.57	793	794	800
	Supply	3.71	7.71	3.61	4.63	767	776	800
2E	General Exhaust	*	*	*	*	*	*	800
	Hood Exhaust	*	*	*	*	*	*	800
	Supply	4.71	3.71	4.63	3.61	776	740	800
2F	General Exhaust	*	*	*	*	*	*	800
	Hood Exhaust	*	*	*	*	*	*	800
	Supply	3.71	2.71	3.61	2.60	740	743	800
2G	General Exhaust	4.42	3.42	3.55	2.54	755	745	800
	Hood Exhaust	4.37	3.37	3.57	2.60	794	769	800

	Terminal Valve	Initial Duct SP	Final Duct SP	Initial Valve ΔP	Final Valve ΔP	Initial BAS Airflow	Final BAS Airflow	Airflow Setpoint	
,	Supply	2.71	3.71	2.59	3.61	776	767	800	
	General Exhaust	3.42	4.42	2.50	3.55	759	755	800	
	Hood Exhaust	3.37	4.37	2.56	3.57	793	794	800	
,	Supply	3.71	7.71	3.61	4.63	767	776	800	
	General Exhaust	*	*	*	*	*	*	800	
	Hood Exhaust	*	*	*	*	*	*	800	



The terminal control valves will be tested for pressure independence and the ability to maintain airflow setpoint across a range of operating static pressures. The valves must maintain the airflow setpoint within 1.5 seconds of the change in static pressure. The test will be conducted at 1300 CFM respectively at each system static pressure.

With the terminal control valves installed with three diameters of straight duct entering and leaving the valves, adjust each fan system static pressure to achieve the minimum operating valve differential pressure at a1300 CFM airflow setpoint for each valve.

Terminal	Initial	Final Duct	Initial	Final Valve	Initial BAS	Final BAS	Airflow
Valve	Duct SP	SP	Valve ΔP	ΔΡ	Airflow	Airflow	Setpoint
Supply	0.00	0.85	0.00	0.61	0	1156	1300
General Exhaust	0.00	2.58	0.00	0.65	0	1136	1300
Hood Exhaust	0.00	2.60	0.00	0.70	0	1240	1300
Supply	0.85	1.87	0.61	1.63	1156	1215	1300
General Exhaust	2.58	3.58	0.65	1.37	1136	1204	1300
Hood Exhaust	2.60	3.61	0.70	1.51	1240	1312	1300
	Valve Supply General Exhaust Hood Exhaust Supply General Exhaust Hood	Valve Duct SP Supply 0.00 General 0.00 Exhaust 0.00 Exhaust 0.00 Supply 0.85 General 2.58 Hood 2.60	ValveDuct SPSPSupply0.000.85General Exhaust0.002.58Hood Exhaust0.002.60Supply0.851.87General Exhaust2.583.58Hood2.603.61	ValveDuct SPSPValve ΔPSupply0.000.850.00General Exhaust0.002.580.00Hood Exhaust0.002.600.00Supply0.851.870.61General Exhaust2.583.580.65Hood2.603.610.70	ValveDuct SPSPValve ΔPΔPSupply0.000.850.000.61General Exhaust0.002.580.000.65Hood Exhaust0.002.600.000.70Supply0.851.870.611.63General Exhaust2.583.580.651.37Hood2.603.610.701.51	ValveDuct SPSPValve ΔPΔPAirflowSupply0.000.850.000.610General Exhaust0.002.580.000.650Hood Exhaust0.002.600.000.700Supply0.851.870.611.631156General Exhaust2.583.580.651.371136Hood Exhaust2.603.610.701.511240	ValveDuct SPSPValve ΔPΔPAirflowAirflowSupply0.000.850.000.6101156General Exhaust0.002.580.000.6501136Hood Exhaust0.002.600.000.7001240Supply0.851.870.611.6311561215General Exhaust2.583.580.651.3711361204Hood2.603.610.701.5112401312

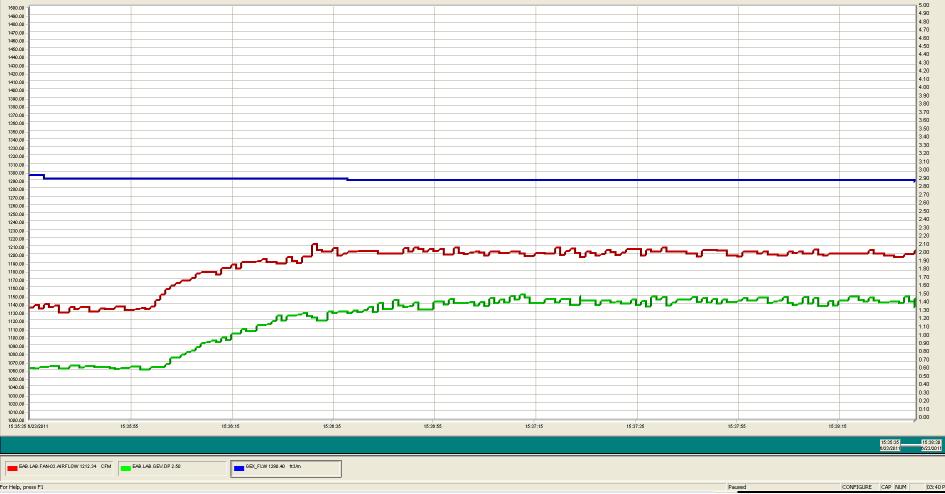
Hood Sash Change In Heating Mode Hood Sash Closed Test Failed





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Terminal	Initial	Final Duct	Initial	Final Valve	Initial BAS	Final BAS	Airflow			
Valve	Duct SP	SP	Valve ΔP	ΔΡ	Airflow	Airflow	Setpoint			
Supply	1.87	2.87	1.63	2.64	1215	1224	1300			
General Exhaust	3.58	4.60	1.37	2.49	1204	1210	1300			
Hood Exhaust	3.61	4.59	1.51	2.54	1312	1322	1300			
Supply	2.87	3.85	2.64	3.61	1224	1251	1300			
General Exhaust	*	*	*	*	*	*	1300			
Hood Exhaust	*	*	*	*	*	*	1300			
Supply	3.71	7.71	3.61	4.63	767	776	1300			
General Exhaust	*	*	*	*	*	*	1300			
Hood Exhaust	*	*	*	*	*	*	1300			
The fan systems could only produce 5"WC. Therefore testing above 5" WC was not performed. * = Did Not Test										



	Terminal	Initial	Final Duct	Initial	Final Valve	Initial BAS	Final BAS	Airflow
	Valve	Duct SP	SP	Valve ΔP	ΔΡ	Airflow	Airflow	Setpoint
	Supply	*	*	*	*	*	*	1300
20	General Exhaust	*	*	*	*	*	*	1300
	Hood Exhaust	*	*	*	*	*	*	1300
	The fan s	ystems co			C. Therefore = Did Not Tes	•	e 5" WC wa	s not
	Supply	3.85	2.85	3.61	2.61	1251	1221	1300
2P	General Exhaust	*	*	*	*	*	*	1300
	Hood Exhaust	*	*	*	*	*	*	1300
	Supply	1.71	0.71	2.61	1.82	1221	1209	1300
2Q	General Exhaust	4.00	3.58	2.49	1.47	1210	1196	1300
	Hood Exhaust	4.59	3.60	2.54	1.54	1322	1301	1300



	Terminal Valve	Initial Duct SP	Final Duct SP	Initial Valve ∆P	Final Valve ΔP	Initial BAS Airflow	Final BAS Airflow	Airflow Setpoint
	Supply	1.85	0.86	1.62	0.62	1209	1151	1300
2R	General Exhaust	3.58	2.58	1.47	0.63	1196	1137	1300
	Hood Exhaust	3.60	2.60	1.54	0.72	1301	1235	1300

Command each terminal control valve to a zero CFM setpoint and command each fan system to maintain 4.75" WC duct static pressure to verify the airflow at the close position.

The valves tested were not full shut off valves. Therefore this test is not applicable. * = Did Not Test

	Terminal Valve	Initial Duct SP	Final Duct SP	Initial Valve ΔP	Final Valve ΔP	Initial BAS Airflow	Final BAS Airflow	Airflow Setpoint
	Supply	*	*	*	*	*	*	*
2S	General Exhaust	*	*	*	*	*	*	*
	Hood Exhaust	*	*	*	*	*	*	*



3. Dynamic Testing – Thermal Demand Override to Heating

The purpose of the following test will be to evaluate the ability of the LCS to control the supply and exhaust values to maintain room offset during a thermal demand situation whereby the zone is commanded from full cooling to full heating. Upon a change of system thermal load, the LCS must gain control within 1.5 seconds and control the airflow to 90% of setpoint.

With the hood sash closed (hood valve at minimum airflow setpoint of 100 FPM) and the zone thermal demand to full heating utilizing the room temperature input in the LCS. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at the minimum operating differential pressure and the maximum airflow setpoint.

Through pretesting the system, the minimum and static pressure setpoint is to achieve maximum airflow at the minimum valve differential pressure were determined as listed in the tests. These remained the same throughout all the dynamic testing.

	Terminal Valve	Duct SP Setpoint	Initial Valve ΔP	Final Valve ∆P	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
	Supply	2.00	1.77	2.09	1310	1400	120	90
3A	General Exhaust	3.50	1.11	3.32	1279	1395	80	90
	Hood Exhaust	3.00	2.85	2.81	213	195	215	195
	Room Offset				-182	-190	-175	-195



3A Thermal Demand Override To Heating





4. Dynamic Testing – Hood Sash Change In Heating Mode

The purpose of the following test will be to evaluate the ability of the LCS to control the supply and exhaust values to maintain room offset during a change in the hood sash position with the zone thermal demand in full heating. Upon a change of system thermal load, the LCS must gain control within 1.5 seconds and control the airflow to 90% of setpoint.

With the hood sash in the minimum position at 100 FPM and the zone thermal demand in full heating, open the hood sash abruptly to the full open position. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at the minimum operating differential pressure and the maximum airflow setpoint.

	Terminal Valve	Duct SP Setpoint	Initial Valve ΔP	Final Valve ∆P	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
	Supply	2.00	1.95	1.92	120	90	630	667
	General Exhaust	3.50	3.31	3.30	80	90	78	89
	Hood Exhaust	3.00	2.85	2.20	215	195	774	780
	Room Offset				-175	-195	-222	-202



4A Hood Sash Change In Heating Mode Hood Sash Opened

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With the hood sash in the full open position at 100 FPM and the zone thermal demand in full heating, close the hood sash. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at the minimum operating differential pressure and the maximum airflow setpoint.

This test failed due to the system's inability to maintain negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 40 CFM positive and .005"WC respectively.

Terminal	Duct SP	Initial	Final	Initial BAS	Initial LCS	Final BAS	Final LCS
Valve	Setpoint	Valve ΔP	Valve ∆P	Airflow	Airflow	Airflow	Airflow
Supply	2.00	1.95	1.92	630	670	120	90
General Exhaust	3.50	3.29	3.33	80	95	80	90
Hood Exhaust	3.00	2.21	2.86	770	780	205	195
Room Offset				-220	-205	-165	-195



4B Hood Sash Change In Heating Mode Hood Sash Closed Test Failed

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										18:15:26 18:18:50 6/22/2011 6/22/2011
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EAE	ALAB.GEV.DP 3.35	EAB.LAB.HEV.DP 2.85	EAB.LAB.MAV.DP 1.95	EAB.LAB.ROOM.DP -0.01	EAB.LAB.ROOM.OF	FSET -167.13				
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With the hood sash in the closed position at 100 FPM and the zone thermal demand in full heating, open the hood sash to the full open position for approximately 10 seconds and then close the hood sash. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at the minimum operating differential pressure and the maximum airflow setpoint.

This test failed due to the system's inability to maintain negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 40 CFM positive and .005"WC respectively.

Terminal Valve	Duct SP Setpoint	Initial Valve ΔP	Final Valve ∆P	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
Supply	2.00	1.95	1.95	120	90	120	90
General Exhaust	3.50	3.30	3.32	85	90	80	95
Hood Exhaust	3.00	2.85	2.84	205	195	205	195
Room Offset				-170	-195	-165	-200



4C Hood Sash Change In Heating Mode Hood Sash Opened & Closed After 10 Seconds Test Failed



5. Dynamic Testing – Thermal Demand Override to Cooling With Hood Full Open

The purpose of the following test will be to evaluate the ability of the LCS to control the supply and exhaust valves to maintain room offset during a thermal demand situation whereby the zone is commanded from full cooling to full heating with the hood sash fully open. Upon a change of system thermal load, the LCS must gain control within 1.5 seconds and control the airflow to 90% of setpoint.

With the hood sash open at 100 FPM and the zone thermal demand to full cooling, command the zone thermal demand to full heating utilizing the room temperature input in the LCS. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at the minimum operating differential pressure and the maximum airflow setpoint.

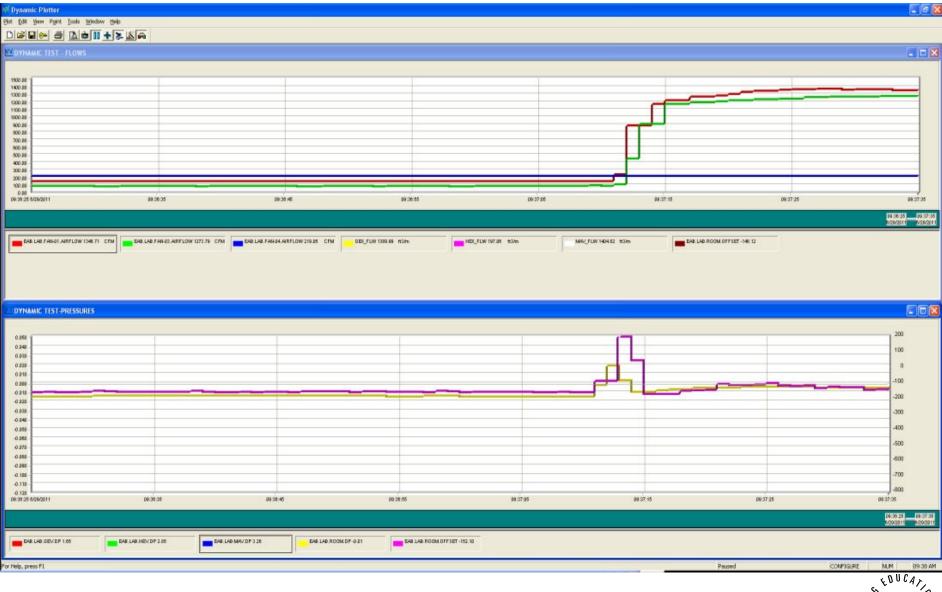
Through pretesting the system, the minimum and static pressure setpoint is to achieve maximum airflow at the minimum valve differential pressure were determined as listed in the tests. These remained the same throughout all the dynamic testing.

	Terminal Valve	Duct SP Setpoint	Initial Valve ΔP	Final Valve ∆P	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
	Supply	3.50	3.42	3.22	152	93	1332	1402
	General Exhaust	4.00	3.72	1.71	87	95	1270	1390
	Hood Exhaust	3.00	2.85	2.85	217	197	217	199
	Room Offset				-152	-199	-155	-187

The lab airflow offset and differential pressure briefly went positive as the supply and exhaູຟຣີtໜູ valves tracked to the increased airflows.



5A Thermal Demand Override To Cooling Test Failed



6. Dynamic Testing – Hood Sash Change In Cooling Mode

The purpose of the following test will be to evaluate the ability of the LCS to control the supply and exhaust values to maintain room offset during a change in the hood sash position with the zone thermal demand in full cooling. Upon a change of system thermal load, the LCS must gain control within 1.5 seconds and control the airflow to 90% of setpoint.

With the hood sash in the minimum position at 100 FPM and the zone thermal demand in full cooling, open the hood sash abruptly to the full open position. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at the minimum operating differential pressure and the maximum airflow setpoint.

Terminal Valve	Duct SP Setpoint		Final Valve ΔP	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
Supply	2.00	1.75	1.78	1315	1465	13	1405
General Exhaust	3.50	1.12	2.59	1275	1395	785	805
Hood Exhaust	3.00	2.83	2.21	205	197	775	780
Room Offset				-165	-187	-220	-180



6A Hood Sash Change In Cooling Mode Hood Sash Opened





With the hood sash in the full open position at 100 FPM and the zone thermal demand in full cooling, close the hood sash. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at the minimum operating differential pressure and the maximum airflow setpoint.

This test failed due to the system's inability to maintain negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 200 CFM positive and .005"WC respectively.

Terminal Valve	Duct SP Setpoint		Final Valve ΔP	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
Supply	2.00	1.77	1.77	1315	1401	1314	1401
General Exhaust	3.50	3.09	1.53	751	803	1309	1407
Hood Exhaust	3.00	2.14	2.85	781	790	211	197
Room Offset				-217	-192	-206	-203



6B Hood Sash Change In Cooling Mode Hood Sash Closed Test Failed

<mark>៥ Dynamic Plotter</mark> Plot <u>E</u> dit <u>Vi</u> ew Point <u>T</u> ools <u>W</u>							
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With the hood sash in the closed position at 100 FPM and the zone thermal demand in full heating, open the hood sash to the full open position for approximately 10 seconds and then close the hood sash. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at the minimum operating differential pressure and the maximum airflow setpoint.

This test failed due to the system's inability to maintain negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 100 CFM positive and .005"WC respectively.

· · · · ·	-						
Terminal Valve	Duct SP Setpoint	Initial Valve ∆P	Final Valve ∆P	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
Supply	2.00	1.71	1.78	1318	1405	1313	1405
General Exhaust	3.50	1.13	1.13	1275	1396	1270	1390
Hood Exhaust	3.00	2.83	2.84	205	200	205	200
Room Offset				-162	-191	-162	-185



6C Hood Sash Change In Cooling Mode Hood Sash Opened & Closed After 10 Seconds Test Failed

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	View Point Tools Window								
	AMIC TEST								
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7. Dynamic Testing- Thermal Demand Override to Heating With Hood Full Open

The purpose of the following test will be to evaluate the ability of the LCS to control the supply and exhaust values to maintain room offset during a thermal demand situation whereby the zone is commanded from full cooling to full heating with the hood sash in the fully open position. Upon a change of system thermal load, the LCS must gain control within 1.5 seconds and control the airflow to 90% of setpoint.

With the hood sash fully open at 100 FPM and the zone thermal demand in full cooling, command the zone thermal demand to full heating utilizing the room temperature input in the LCS. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at the minimum operating differential pressure and the maximum airflow setpoint.

	Terminal Valve	Duct SP Setpoint	Initial Valve ∆P	Final Valve ∆P	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
	Supply	2.00	1.79	2.51	1312	1401	622	678
7A	General Exhaust	3.50	2.58	3.32	754	805	87	91
	Hood Exhaust	3.00	2.19	2.18	787	790	782	790
	Room Offset				-229	-194	-247	-203



7A Thermal Demand Override To Heating With Hood Full Open

ilot Edit View Point Tools						
V DYNAMIC TEST - FLOW						
1600.00						
1500.00 - 1400.00 -						
1300.00 - 1200.00 -						
1100.00 -						
900.00 -						
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500.00 - 400.00 -						
300.00 - 200.00 -						
100.00	10:27:10	10:27:20	10:27:30	10:27:40	10:27:50	10:28:00
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						10:27:00 6/24/2011 6/24/2011
EAB.LAB.FAN-01.AIRFLOW	/ 618.43 CFM EAB.LAB.FAN-03.AIRFLOW 87.72 CFM EA	B.LAB.FAN-04.AIRFLOW 779.21 CFM GEX_F	HEC_FLW 790.34 ft3/m	MAV_FLW 678.04 ft3/m	EAB.LAB.ROOM.OFFSET -261.29	
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8. Dynamic Testing- Exhaust System Failure With Setpoint Control

The following test will simulate loss of exhaust airflow and evaluate the ability of the LCS to track airflow offset based upon setpoint control. Based upon the setpoint, the terminal control valves will maintain airflow position and airflow setpoint.

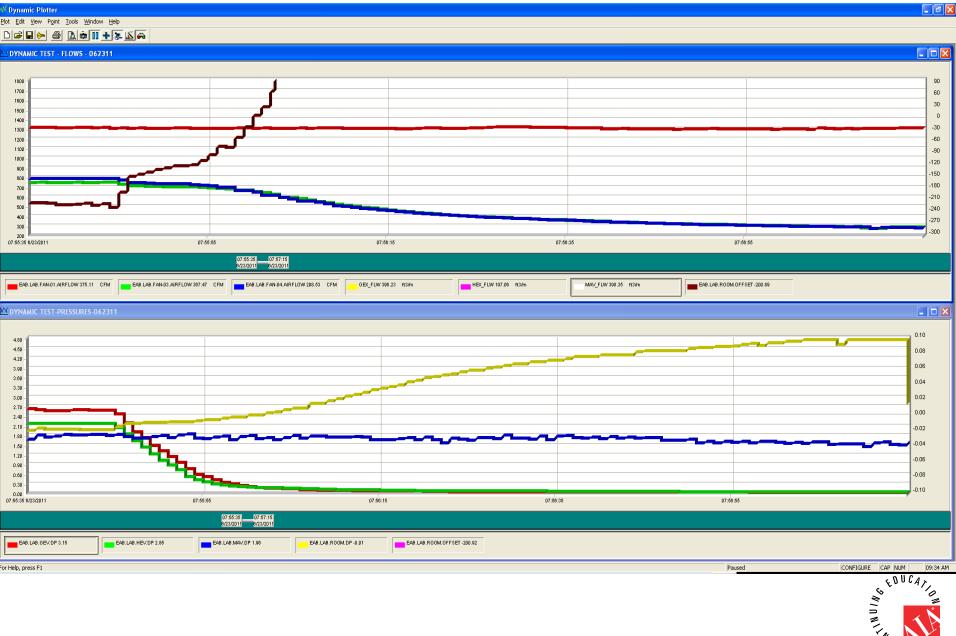
Place the LCS and temperature override in full cooling with hood sash fully open and de-energize both exhaust fans systems. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

This system does not actively control airflow and therefore is always in setpoint control. The valve differential pressure is monitored and alarms when the DP is below the minimum setpoint of 0.6" WC. When this alarm is active, the airflow feedback from the LCS is failed.

		Duct SP	Initial	Final	Initial BAS	Initial LCS		Final LCS
	Valve	Setpoint	Valve ΔP	Valve ΔP	Airflow	Airflow	Airflow	Airflow
	Supply	2.00	1.81	1.53	1309	1496	1301	1398
8A	General Exhaust	3.50	2.59	0.01	752	803	238	Unreliable
	Hood Exhaust	3.00	2.17	0.02	787	795	241	Unreliable
	Room Offset				-230	-202	822	



8A Dynamic Testing- Exhaust System Failure With Setpoint Control Test Failed





9. Dynamic Testing- Exhaust System Failure With Offset Control

The following test will simulate loss of exhaust airflow and evaluate the ability of the LCS to track airflow offset based upon flow tracking control. Based upon tracking control, the terminal control valves will modulate to attempt to maintain offset when the exhaust flow is reduced.

Place the LCS and temperature override in full cooling with hood sash fully open and de-energize both exhaust fans systems. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

This LCS does not actively control airflow and therefore is always in setpoint control. This portion of the test was not conducted.

	Terminal	Duct SP	Initial	Final	Initial BAS	Initial LCS	Final BAS	Final LCS
	Valve	Setpoint	Valve ΔP	Valve ∆P	Airflow	Airflow	Airflow	Airflow
	Supply		*	*	*	*	*	*
9A	General Exhaust		*	*	*	*	*	*
	Hood Exhaust		*	*	*	*	*	*
	Room Offset				*	*	*	*
* = Did Not Test								



10. Dynamic Testing- Supply System Failure With Setpoint Control

The following test will simulate loss of supply airflow and evaluate the ability of the LCS to track airflow offset based upon setpoint control. Based upon the setpoint, the terminal control valves will maintain airflow position and airflow setpoint.

Place the LCS and temperature override in full cooling with hood sash fully open and de-energize the supply fan system. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

This system does not actively control airflow and therefore is always in setpoint control. The valve differential pressure is monitored and alarms when the DP is below the minimum setpoint of 0.6" WC. When this alarm is active, the airflow feedback from the LCS is failed.

	Terminal	Duct SP	Initial	Final	Initial BAS	Initial LCS	Final BAS	Final LCS
	Valve	Setpoint	Valve ΔP	Valve ∆P	Airflow	Airflow	Airflow	Airflow
	Supply	2.00	1.78	0.04	1300	1394	362	Unreliable
10A	General Exhaust	3.50	2.60	2.27	750	801	750	801
	Hood Exhaust	3.00	2.21	1.88	769	790	767	790
	Room Offset				-219	197	1155	







10A Dynamic Testing- Supply System Failure With Setpoint Control Test Failed

11. Dynamic Testing- Supply System Failure With Offset Control

The following test will simulate loss of supply airflow and evaluate the ability of the LCS to track airflow offset based upon flow tracking control. Based upon tracking control, the terminal control valves will modulate to attempt to maintain offset when the exhaust flow is reduced.

Place the LCS and temperature override in full cooling with hood sash fully open and de-energize the supply fan system. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

This LCS does not actively control airflow and therefore is always in setpoint control. This portion of the test was not conducted.

	Terminal Valve	Duct SP Setpoint	Initial Valve ∆P	Final Valve ∆P	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
	Supply		*	*	*	*	*	*
11A	General Exhaust		*	*	*	*	*	*
	Hood Exhaust		*	*	*	*	*	*
	Room Offset				*	*	*	*
* = Did Not Test								



12. Unoccupied Mode and Occupancy Override

The LCS will be tested for unoccupied operation and the ability to accept an occupancy sensor input to reduce the laboratory airflows. Upon a change in occupancy status, the LCS must react and reach the required airflow setpoints within 1.5 seconds and 90% of the required airflow.

With the LCS in occupied mode, the hood fully closed, and the thermal demand in full cooling, simulate a change of occupancy by flipping the occupancy switch to the unoccupied mode. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

	Terminal	Duct SP	Initial	Final	Initial BAS	Initial LCS	Final BAS	Final LCS
	Valve	Setpoint	Valve ΔP	Valve ΔP	Airflow	Airflow	Airflow	Airflow
	Supply	2.00	1.75	1.96	1318	1409	378	398
12A	General Exhaust	3.50	1.07	3.14	1285	1396	370	396
, .	Hood Exhaust	3.00	2.84	2.87	208	197	211	197
	Room Offset				-175	-184	-203	-195





12. Occupied Mode to Unoccupied Mode

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With the LCS in unoccupied mode, the hood fully closed, and the thermal demand in full cooling, simulate a change of occupancy by flipping the occupancy switch to occupied mode. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

The tests failed due to the systems inability to maintain a negative airflow offset and laboratory negative pressure when the change in occupancy mode went from unoccupied to occupied while the system was in full cooling. The dynamic test reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 300 CFM positive and 0.015" WC respectively.

	Terminal Valve	Duct SP Setpoint	Initial Valve ΔP	Final Valve ΔP	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow		
	Supply	3.50	3.47	3.25	152	91	1345	1465		
		0.00	0.77	0.20	102					
12B	General Exhaust	4.00	3.82	1.65	93	93	1269	1392		
	Hood Exhaust	3.00	2.86	2.85	216	199	216	199		
	Room Offset				-157	-201	-140	-186		





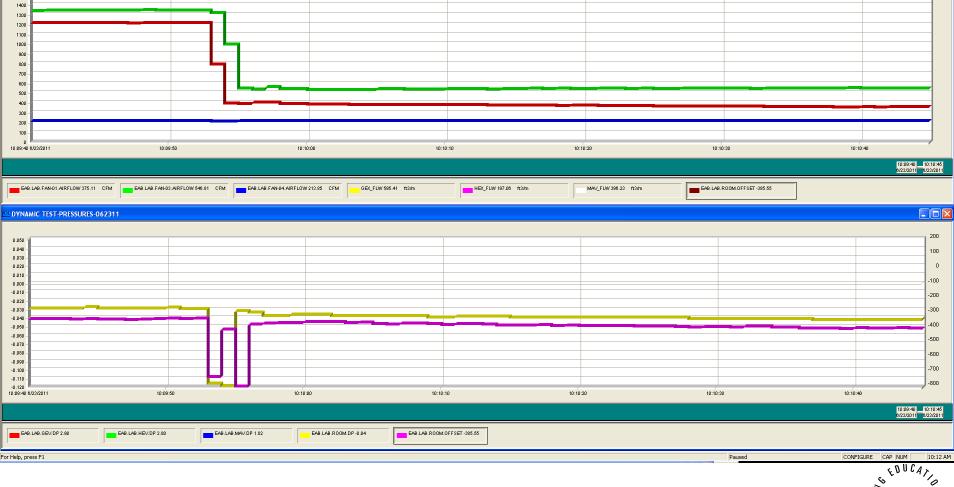
12B Unoccupied Mode to Occupied Mode Test Failed

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Change room offset setpoint to -400 CFM. With the LCS in occupied mode, the hood fully closed, and the thermal demand in full cooling, simulate a change of occupancy by flipping the occupancy switch to unoccupied mode. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

		Duct SP		Final	Initial BAS	Initial LCS		Final LCS		
	Valve	Setpoint	Valve ΔP	Valve ΔP	Airflow	Airflow	Airflow	Airflow		
	Supply	2.00	1.78	1.99	1216	1293	375	396		
12C	General Exhaust	3.50	0.85	2.90	1336	1490	545	594		
	Hood Exhaust	3.00	2.81	2.81	211	197	211	197		
	Room Offset				-331	-394	-381	-395		





12C With -400 CFM Offset Change from Occupied Mode to Unoccupied Mode

🚧 Dynamic Plotter

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With the LCS in unoccupied mode, the room offset setpoint at -400 CFM. the hood fully closed, and the thermal demand in full cooling, simulate a change of occupancy by flipping the occupancy switch the occupied mode. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

The tests failed due to the systems inability to maintain a negative airflow offset and laboratory negative pressure when the change in occupancy mode went from unoccupied to occupied while the system was in full cooling. The dynamic test reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 300 CFM positive and 0.005" WC respectively.

	Terminal	Duct SP	Initial	Final	Initial BAS	Initial LCS	Final BAS	Final LCS		
	Valve	Setpoint	Valve ∆P	Valve ΔP	Airflow	Airflow	Airflow	Airflow		
	Supply	3.50	3.44	3.35	152	89	1225	1289		
12D	General Exhaust	4.00	3.65	1.27	271	297	1358	1477		
	Hood Exhaust	3.00	2.82	2.83	216	199	216	199		
	Room Offset				-335	-470	-348	-387		



12D With -400 CFM Offset Change from Occupied Mode to Unoccupied Mode Test Failed



13. Dynamic Testing – Change Hood Velocity Setpoint

The purpose of these tests is to show that the system can be changed to maintain a higher hood face velocity setpoint and continue to track across the operating range of the system. The system must achieve control within 1.5 seconds and maintain 90% of the airflow setpoint.

Utilizing the LCS controls, modified the hood controller to maintain 150 FPM face velocity with the hood sash closed and the system in full heating demand. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

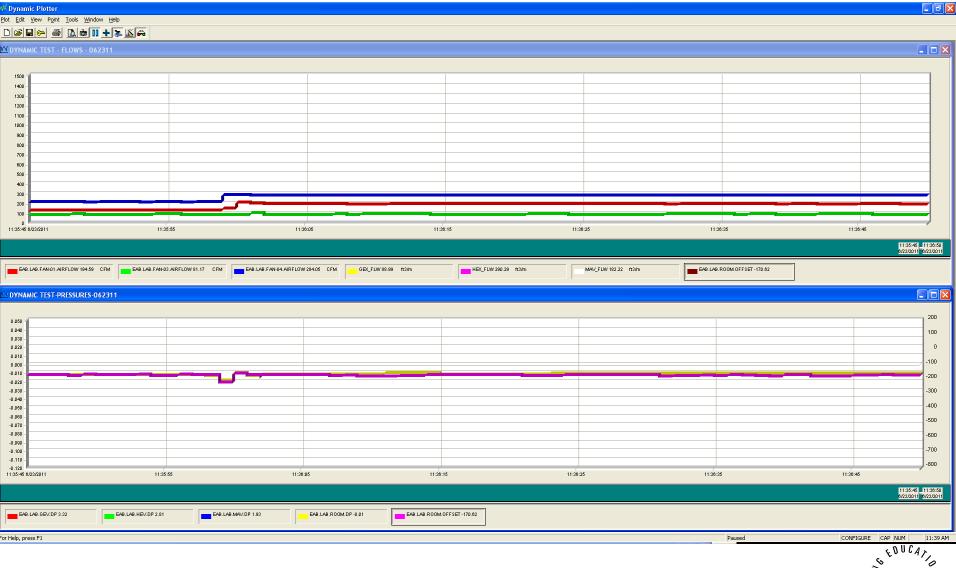
The LCS system cannot change hood face velocity with one set point change in the controller. The hood controller must be reconfigured for the face velocity setpoint change as well.

	Terminal Valve	Duct SP Setpoint	Initial Valve ΔP	Final Valve ΔP	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
	Supply	2.00	1.93	1.97	124	93	1332	1402
13A	General Exhaust	3.50	3.31	3.32	81	95	1270	1390
13A	Hood Exhaust	3.00	2.85	2.81	213	197	217	199
	Room Offset				-175	-197	-247	-205





13A Modify The Hood Sash Controller to Maintain 150 FPM With Sash Closed in Full Heating Demand

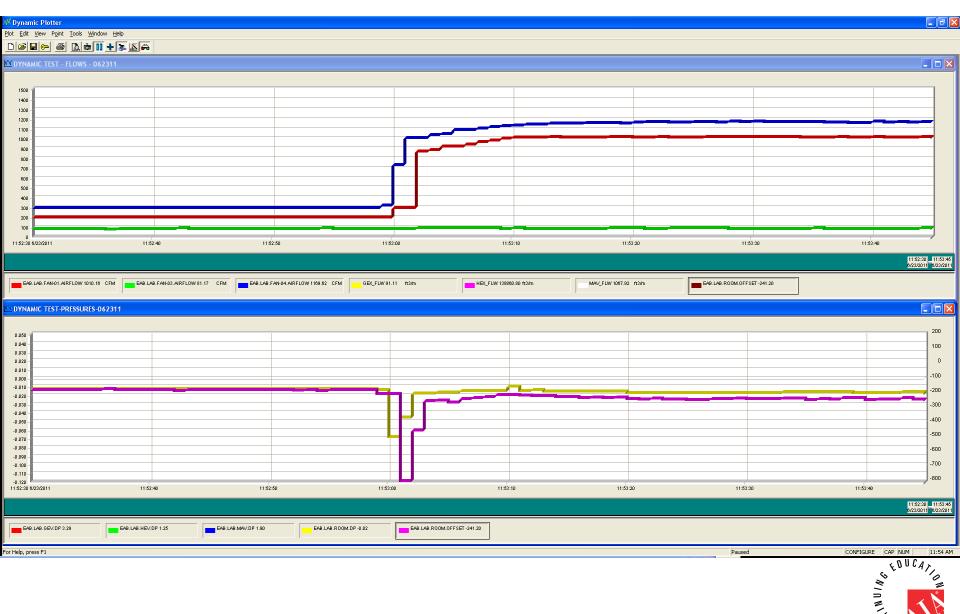


With the LCS in full heating demand, raise the hood sash to full height at 150 FPM. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

	Terminal Valve	Duct SP Setpoint	Initial Valve ΔP	Final Valve ΔP	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
	Supply	2.00	1.94	1.87	197	182	1010	1088
13B	General Exhaust	3.50	3.33	3.32	81	89	87	91
100	Hood Exhaust	3.00	2.80	1.30	291	290	1170	1182
	Room Offset				-175	-197	-247	-205



13B With the LCS in Full Heating Demand and Face Velocity at 150 FPM Raise the Sash to Full Height

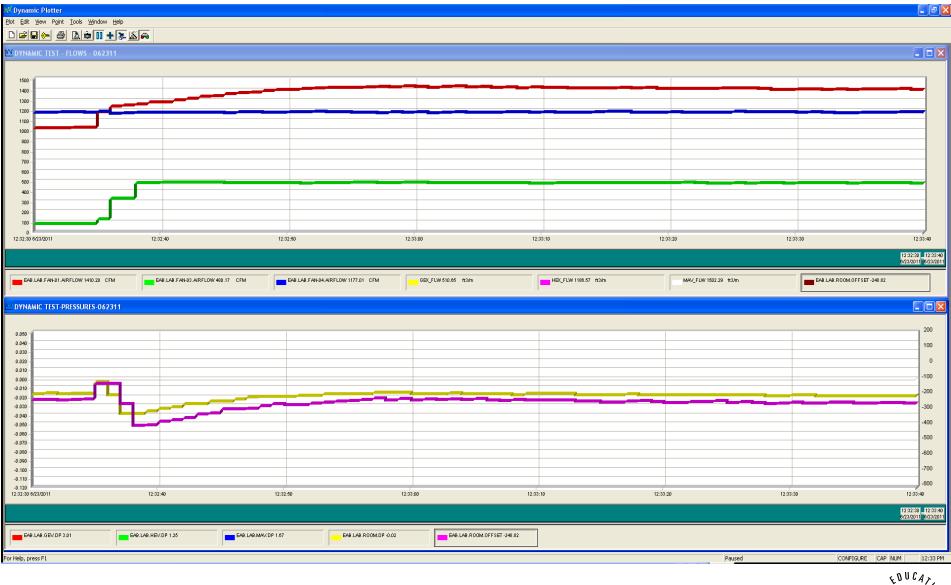


With the hood sash at full height at 150 FPM, command the LCS to full cooling demand. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

	Terminal Valve	Duct SP Setpoint	Initial Valve ΔP	Final Valve ΔP	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow	
	Supply	2.00	1.82	1.70	1028	1081	1404	1502	
13C	General Exhaust	3.50	3.32	3.04	81	89	478	511	
130	Hood Exhaust	3.00	1.20	1.29	1177	1187	1181	1187	
	Room Offset				-236	-195	-255	-196	



13C With the Hood Sash Fully Open Command the LCS to Full Cooling





With the LCS set to full cooling demand and the hood sash at full height at 150 FPM, close the hood sash to the minimum position. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint.

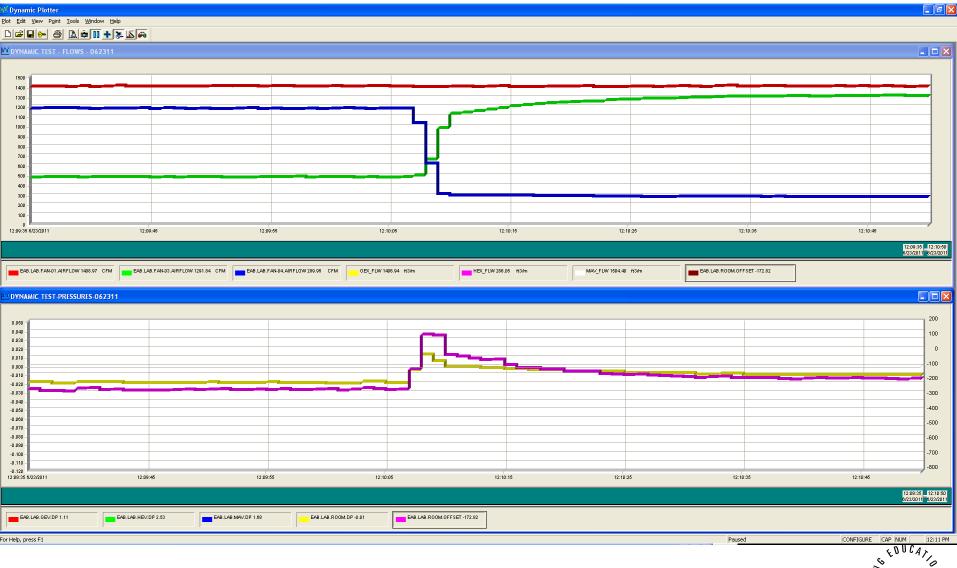
The test failed due to the system's inability to maintain a negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 100 CFM positive and 0.010" WC respectively.

	Terminal Valve	Duct SP Setpoint	Initial Valve ∆P	Final Valve ∆P	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
	Supply	2.00	1.75	1.69	1406	1504	1409	1504
13D	General Exhaust	3.50	2.99	1.09	482	513	1290	1407
130	Hood Exhaust	3.00	1.23	2.80	1185	1192	289	286
	Room Offset				-261	-201	-170	-189





13D With the LCS Set For Full Cooling Modulate Fume Hood Sash From Full Open to Full Closed at 150 FPM Test Failed



14. Dynamic Testing – Terminal Valve Power Failure

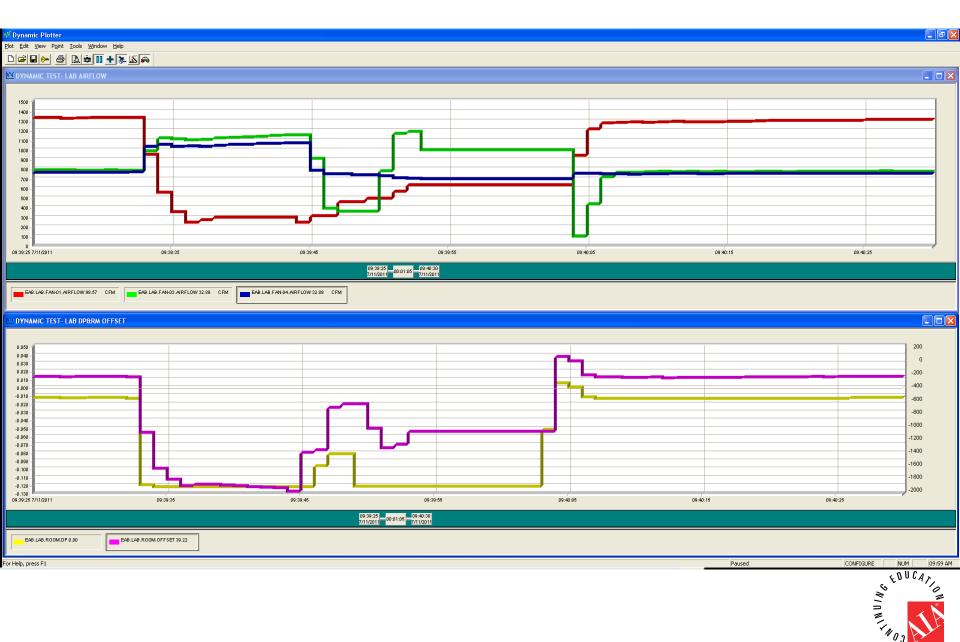
The following test will simulate the loss of power to the terminal control valves and evaluate the ability of the LCS to track airflow offset based upon setpoint tracking control. Based upon the setpoint, the terminal control valves will maintain airflow position and airflow offset.

Place the LCS in temperature override in full cooling with the hood sash fully open and deenergize the terminal valves for approximately 10 seconds then restore the power to the terminal valves. The BAS will be configured to maintain a duct static pressure in each system at the minimum setpoint to maintain each valve at a minimum operating differential pressure at the maximum airflow setpoint. The test failed due to the systems inability to maintain a negative airflow offset and laboratory negative pressure after the power was restored in the terminal valves. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 100 CFM positive and 0.005" WC respectively.

							· · ·	
	Terminal Valve	Duct SP Setpoint	Initial Valve ΔP	Final Valve ∆P	Initial BAS Airflow	Initial LCS Airflow	Final BAS Airflow	Final LCS Airflow
	Supply	3.50	3.24	3.15	1330	1400	1336	1400
14A	General Exhaust	3.50	2.53	2.55	785	809	769	817
	Hood Exhaust	3.00	2.24	2.25	762	790	757	773
	Room Offset				-217	-199	-190	-190

NUN.

14A Dynamic Testing- Terminal Valve Power Failure Test Failed



Issues With Venturi- Valve 1 – Mechanical Airflow Control

Issue

2J General and Hood Exhaust Valves Required a DP > 0.60" WC, Test Failed The general and hood exhaust valves each required a valve DP greater than 0.6" WC for the BAS flow alarm to achieve a non-alarm state. This test failed due to the supply, general exhaust, and hood valves exhibiting and airflow change greater than 5% whenever the duct static pressure required a minimum valve differential pressure of 0.6" WC was increase by 1 WC". Thereafter, all valves maintained airflow changes within the 5% testing criteria of the steady-state airflow for the remaining variable static pressure test.

4B Hood Sash Change In Heating Mode Hood Sash Open to Closed, Test Failed This test failed due to the system's inability to maintain negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 40 CFM positive and .005"WC respectively.



Issues With Venturi - Valve1 – Mechanical Airflow Control

Issue

4C Hood Sash Change In Heating Mode Hood Sash Opened & Closed After 10 Seconds ,Test Failed

This test failed due to the system's inability to maintain negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 40 CFM positive and .005"WC respectively.

5A Thermal Demand Override To Cooling Test Failed

The lab airflow offset and differential pressure briefly went positive as the supply and exhaust valves tracked to the increased airflows.

6B Hood Sash Change In Cooling Mode Hood Sash Closed Test Failed This test failed due to the system's inability to maintain negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 200 CFM positive and .005"WC respectively.



Issues With Venturi - Valve1 – Mechanical Airflow Control

Issue

6C Hood Sash Change In Cooling Mode Hood Sash Opened & Closed After 10 Seconds Test Failed

This test failed due to the system's inability to maintain negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 100 CFM positive and .005"WC respectively.

8A Dynamic Testing- Exhaust System Failure With Setpoint Control Test Failed This system does not actively control airflow and therefore is always in setpoint control. The valve differential pressure is monitored and alarms when the DP is below the minimum setpoint of 0.6" WC. When this alarm is active, the airflow feedback from the LCS is failed.

9A Dynamic Testing- Exhaust System Failure With Offset Control Not Tested This LCS does not actively control airflow and therefore is always in setpoint control. This portion of the test was not conducted.

11A Dynamic Testing- Supply System Failure With Offset Control This LCS does not actively control airflow and therefore is always in setpoint control. This portion of the test was not conducted.

Issues With Venturi - Valve1 – Mechanical Airflow Control

Issue

12B Unoccupied Mode to Occupied Mode Test Failed

The tests failed due to the systems inability to maintain a negative airflow offset and laboratory negative pressure when the change in occupancy mode went from unoccupied to occupied while the system was in full cooling. The dynamic test reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 300 CFM positive and 0.015" WC respectively.

12D With -400 CFM Offset Change from Occupied Mode to Unoccupied Mode Test Failed

The tests failed due to the systems inability to maintain a negative airflow offset and laboratory negative pressure when the change in occupancy mode went from unoccupied to occupied while the system was in full cooling. The dynamic test reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 300 CFM positive and 0.005" WC respectively.



Issue

13D With the LCS Set For Full Cooling Modulate Fume Hood Sash From Full Open to Full Closed at 150 FPM Test Failed

The test failed due to the system's inability to maintain a negative airflow offset and laboratory negative pressure when the fume hood sash was modulated from the full open to the full close positions. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 100 CFM positive and 0.010" WC respectively.

14A Dynamic Testing- Terminal Valve Power Failure Test Failed The test failed due to the systems inability to maintain a negative airflow offset and laboratory negative pressure after the power was restored in the terminal valves. The dynamic test data reveals that the loss of offset and subsequent pressure was less than two seconds with a maximum airflow offset and room pressure of 100 CFM positive and 0.005" WC respectively.



Issue

8C.4 At an airflow setpoint of 90 CFM, the supply valve exhibited an airflow change greater than five percent of the steady state value when the measured airflow at a valve differential static pressure of 2.0" WC was compared to the measured airflow at a valve differential static pressure of 0.60" WC.

8C.8 & 8C.9 At an airflow setpoint of 90 CFM, the general exhaust valve exhibited an airflow change greater than five percent of the steady state value when measured airflows at a valve differential static pressure of 2.0" WC and 3.0" WC were compared to the measured airflow at a differential static pressure of 0.6" WC.

1E At an airflow setpoint of 800 CFM, the supply valve exhibited an airflow change greater than five percent of the steady state value with three diameters of straight duct entering and leaving the valve whenever the valve was connected ninety degrees directly into a plenum tap and the discharge connected ninety degrees directly into a plenum tap.



Issue

2A, 2B, 2C At an airflow setpoint of 800 CFM, the supply valve exhibited an airflow change greater than five percent of the steady state value when the measured airflows at a valve differential static pressure of 2.6, 1.6 and 0.6 IWC with decreasing static pressure were compared to the measured airflow at a valve differential static pressure of 0.60 IWC with increasing static pressure.

2C At an airflow setpoint of 800 CFM, the hood exhaust valve exhibited an airflow change greater than five percent of the steady state value when the measured airflow at a valve differential static pressure of 2.7 IWC with increasing static pressure was compared to the measured airflow at a valve differential static pressure of 0.60 IWC with increasing static pressure.

2G, 2H, 2I At an airflow setpoint of 800 CFM, the hood exhaust valve exhibited an airflow change greater than five percent of the steady state value when the measured airflows at a valve differential static pressure of 2.8, 1.65 and 0.7 IWC with decreasing static pressure were compared to the measured airflow at a valve differential static pressure of 0.60 IWC with increasing static pressure.



Issue

2K & 2L At an airflow setpoint of 1300 CFM, the hood exhaust valve exhibited an airflow change greater than five percent of the steady state value when the measured airflows at a valve differential static pressure of 1.45 and 2.45 IWC with increasing static pressure were compared to the measured airflow at a valve differential static pressure of 0.60 IWC with increasing static pressure.

2Q At an airflow setpoint of 1300 CFM, the hood exhaust valve exhibited an airflow change greater than five percent of the steady state value when the measured airflow at a valve differential static pressure of 1.4 IWC with decreasing static pressure was compared to the measured airflow at a valve differential static pressure of 0.60 IWC with increasing static pressure.



Issue

2K & 2L At an airflow setpoint of 1300 CFM, the hood exhaust valve exhibited an airflow change greater than five percent of the steady state value when the measured airflows at a valve differential static pressure of 1.45 and 2.45 IWC with increasing static pressure were compared to the measured airflow at a valve differential static pressure of 0.60 IWC with increasing static pressure.

2Q At an airflow setpoint of 1300 CFM, the hood exhaust valve exhibited an airflow change greater than five percent of the steady state value when the measured airflow at a valve differential static pressure of 1.4 IWC with decreasing static pressure was compared to the measured airflow at a valve differential static pressure of 0.60 IWC with increasing static pressure.



Issue

4B Hood Sash Change in Heating Mode – Full Open to Fully Closed – Test Failed Whenever the fume hood sash was modulated from fully closed to the fully open position for approximately 10 seconds then fully closed while in heating mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum loss of negative airflow was 100 CFM positive and laboratory pressure was +0.01" WC for less than 2 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 2 seconds.

4C Hood Sash Change in Heating Mode – Full Open, 10Second Delay to Fully Closed – Test Failed

Whenever the fume hood sash was modulated from fully closed to the fully open position for approximately 10 seconds then fully closed while in heating mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum loss of negative airflow was 100 CFM positive and laboratory pressure was +0.01" WC for less than 2 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 2 seconds.



Issue

6A Hood Sash Change in Cooling Mode – Full Closed to Fully Open – Test Failed

Whenever the fume hood sash was modulated from fully closed to the fully open position while in full cooling mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum loss of negative airflow was 60 CFM positive and laboratory pressure was +0.01" WC for less than 1 second. The maximum delay in airflow control to 90% of setpoint was approximately 3 seconds.

6B Hood Sash Change in Cooling Mode– Full Open to Fully Closed – Test Failed

Whenever the fume hood sash was modulated from fully open to the fully closed position while in full cooling mode, there was a brief loss of negative airflow offset within the lab and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum loss of negative airflow was 100 CFM positive for less than 1 second. The maximum delay in airflow control to 90% of setpoint was approximately 3 seconds.



Issue

6C Hood Sash Change in Cooling Mode – Full Closed, Wait 10 Seconds to Fully Open Test Failed

Whenever the fume hood sash was modulated from fully closed to the fully open position while in full cooling mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum loss of negative airflow was 60 CFM positive and laboratory pressure was +0.01" WC for less than 1 second. The maximum delay in airflow control to 90% of setpoint was approximately 3 seconds.

9A Exhaust System Failure With Offset Control Test Failed

Whenever an exhaust system failure was initiated, the lab went extremely positive. The supply valve did not track down to maintain a negative environment once the exhaust valves exhibited a differential pressure alarm.



Issue

11A Supply Fan System Failure With Offset Control Test Failed

Whenever a supply system failure was initiated, the lab temporarily went positive. The general exhaust valve closed once the supply valve exhibited a valve static pressure alarm thus causing the space to go positive as the supply fan was deenergized and decreasing in speed. However, TRIATEK stated that they are in the process of modifying the programming to allow the system to maintain the programmed offset environment.

12A Unoccupied Mode and Occupancy Override – BAS Commanded to Unoccupied Mode - Test Failed

Whenever a state change from occupied to unoccupied mode was initiated with the hood sash fully closed, there was a brief loss of negative airflow offset within the lab and loss of laboratory negative pressure. The test data revealed that the maximum loss of negative airflow was 50 CFM positive and laboratory pressure was +0.01" WC for less than 1 second.



Issue

13C Unoccupied Mode and Occupancy Override – BAS Command to Unoccupied Mode With -400CFM Offset Test Failed

Whenever a state change from full heating to full cooling mode was initiated with the hood sash fully open at 125 FPM, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The maximum delay in airflow control to 90% of setpoint was approximately 2 seconds.

13D Unoccupied Mode and Occupancy Override – BAS Command to Occupied Mode With -400 CFM Offset Test Failed

Whenever the fume hood sash was modulated from fully open to the fully closed position at 125 FPM while in full cooling mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum loss of negative airflow was 165 CFM positive and laboratory pressure was +0.02" WC for less than 2 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 3 seconds.



Issue

4A Hood Sash Change in Heating Mode From Full Close to Full Open – Test Failed

Whenever the fume hood sash was modulated from the fully closed position to the fully open position while in heating mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The maximum delay in airflow control to 90% of setpoint was approximately 2 seconds.

4C Hood Sash Change in Heating Mode – Fully Open, 10 Second Delay, Fully Closed Test Failed

Whenever the fume hood sash was modulated from the fully closed position to the fully open position for approximately 10 seconds then fully closed while in heating mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The maximum delay in airflow control to 90% of setpoint was approximately 3 seconds.



Issue

6A Hood Sash Change in Cooling Mode From Full Close to Full Open – Test Failed

Whenever the fume hood sash was modulated from the fully closed position to the fully open position while in cooling mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The maximum delay in airflow control to 90% of setpoint was approximately 2 seconds.

6C Hood Sash Change in Cooling Mode – Fully Closed, 10 Second Delay, Fully Open Test Failed

Whenever the fume hood sash was modulated from the fully closed position to the fully open position for approximately 10 seconds then fully closed while in heating mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The maximum delay in airflow control to 90% of setpoint was approximately 3 seconds.



Issue

10A Supply System Failure With Offset Control – Test Failed

Whenever the occupancy was commanded from unoccupied to occupied mode while in cooling mode with a negative 400 CFM offset, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The maximum delay in airflow control to 90% of setpoint was approximately 4 seconds.

11D Unoccupied Mode and Occupancy Override – BAS Command Mode With -400 CFM Offset - Test Failed

Whenever the fume hood sash was modulated from the fully closed position to the fully open position while in cooling mode and the face velocity at 125 FPM, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The maximum delay in airflow control to 90% of setpoint was approximately 2 seconds.



Issue

13A Terminal Valve Power Failure - Test Failed

Whenever a terminal valve power failure was initiated, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum delay in airflow control to 90% of setpoint was approximately 25 seconds.



Issue

2 Airflow Accuracy With Variable Static Pressure – Test Failed

With an airflow set point of 800 CFM the supply and exhaust valves exhibited a maximum airflow change of 13% and 9% respectively whenever the duct static pressure was increased then decreased above the minimum static pressure required.

With an airflow set point of 1300 CFM the supply and exhaust valves exhibited a maximum airflow change of 25% and 16% respectively whenever the duct static pressure was increased then decreased above the minimum static pressure required.

3A Thermal Demand Override to Heating – Test Failed

Whenever a state change from full cooling to full heating mode was initiated with the hood sash fully closed, the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The maximum delay in airflow control to 90% of set point was approximately 13 minutes.



Issue

4A Hood Sash Change in Heating Mode – Full Closed to Fully Open – Test Failed

Whenever the fume hood sash was modulated from fully closed to fully open while in heating mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The maximum delay in airflow control to 90% of set point was approximately 15 seconds.

4B Hood Sash Change in Heating Mode – Full Open to Fully Closed – Test Failed

Whenever the fume hood sash was modulated from fully open to fully closed while in heating mode, there was a brief loss of the negative airflow offset within the lab, loss of laboratory negative pressure and LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The test data revealed that the maximum loss of negative airflow was 95 CFM positive and laboratory pressure was +0.01" WC for less than 4 seconds. The maximum delay in airflow control to 90% of set point was approximately 8 seconds.



Issue

4C Hood Sash Change in Heating Mode – Full Open, 10-Second Delay to Fully Closed – Test Failed

Whenever the fume hood sash was modulated from fully closed to fully open for 10 seconds then fully closed while in heating mode, there was a brief loss of the negative airflow offset within the lab, loss of laboratory negative pressure and LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The test data revealed the maximum loss of negative airflow was 65 CFM positive and laboratory pressure was +0.01" WC for approximately 3 seconds. The maximum delay in airflow control to 90% of set point was approximately 8 seconds.

5A Demand Override To Cooling - Test Failed

Whenever the thermal demand was switched from full heating to full cooling, the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The maximum delay in airflow control to 90% of set point was approximately 14 minutes.



Issue

6A– Hood Sash Change in Cooling Mode – Full Closed to Fully Open – Test Failed

Whenever the fume hood sash was modulated from fully closed to fully open while in full cooling mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The maximum delay in airflow control to 90% of set point was approximately 6 seconds.

6B - Hood Sash Change in Cooling Mode – Full Open to Fully Closed– Test Failed

Whenever the fume hood sash was modulated from fully open to fully closed while in full cooling mode the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The maximum delay in airflow control to 90% of set point was approximately 6 seconds.



Issue

6C– Hood Sash Change in Cooling Mode – Fully Closed, 10 Second Delay, Fully Open -Test Failed

Whenever the fume hood sash was modulated from fully closed to fully open for 10 seconds then fully closed while in full cooling mode the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The maximum delay in airflow control to 90% of set point was approximately 6 seconds.

7A – Thermal Demand Override From Full Cooling to Full Heating– Test Failed Whenever the thermal demand was switched from full cooling to full heating with hood sash fully open, the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The maximum delay in airflow control to 90% of set point was approximately 8 minutes.



Issue

10A– Supply System Failure With Setpoint Control-Test Failed

Whenever the supply system was de-energized with the system in full heating, there was a brief loss of the negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. Once a differential static pressure alarm of the supply valve was activated, the general exhaust valve closed causing the lab to go positive for approximately 25 seconds as the supply airflow decreased. The hood exhaust valve maintained airflow to set point as the supply airflow decreased causing the space to become negative after 25 seconds.

12A – Occupancy Mode Switched from Occupied to Unoccupied– Test Failed Whenever the occupancy mode was switched from occupied to unoccupied while in full cooling mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The maximum delay in airflow control to 90% of set point was approximately 14 seconds.



Issue

12B– Occupancy Mode Switched from Unoccupied to Occupied– Test Failed Whenever the occupancy mode was switched from unoccupied to occupied while in full cooling mode, there was a brief loss of the negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The test data revealed that the maximum loss of negative airflow was 315 CFM positive and laboratory pressure was +0.04" WC for less than 1 second. The maximum delay in airflow control to 90% of set point was approximately 9 seconds. The LCS mode went to full heating airflows once in occupied mode then modulated to full cooling airflows similar to the full heating to full cooling tests

12C– Occupancy Mode Switched from Occupied to Unoccupied With an Offset set for -400 CFM– Test Failed

Whenever the occupancy mode was switched from occupied to unoccupied mode while in full cooling mode with airflow offset at -400 CFM the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The maximum delay in airflow control to 90% of set point was approximately 18 seconds.



Issue

12D– Occupancy Mode Switched from Unoccupied to Occupied With an Offset set for -400 CFM– Test Failed

Whenever the occupancy mode was switched from unoccupied to occupied mode while in full cooling mode with airflow offset of -400 CFM, there was a brief loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of set point. The test data revealed that the maximum loss of laboratory pressure was +0.02" WC for less than 1 second. The maximum delay in airflow control to 90% of set point was approximately 8 seconds. Upon starting, the LCS went to full heating airflows once in occupied mode then modulated to full cooling airflows similar to the full heating to full cooling tests.

14A–Terminal Valve Power Failure Test Failed

Whenever the power to the terminal valves was terminated then restored after 10 seconds, the room pressure and airflow in the lab went positive for about 3 seconds after the power was restored and the control valves were initializing.



Issue

Extra Test- Separate Power Source to Control Panel Terminated for 10 Seconds

Whenever the power to the control panel, which has a separate power source than the terminal valves, was terminated then restored after 10 seconds the supply, general exhaust and hood valves closed immediately once de-energized. Once the power was restored the room pressure and airflow in the lab went positive for approximately 4 seconds after the power was restored and the control valves were initializing.

Extra Test- Differential Static Pressure Alarm Activated

Whenever a differential static pressure alarm of the supply terminal valve was activated, the general exhaust valve would immediately close.



Issues With Blade Damper – Valve 5 – Butterfly Damper- Digital Airflow Control

Issue

6C – Hood Sash Change in Cooling Mode – Fully Closed, 10 Second Delay, Fully Open -Test Failed

Whenever the fume hood sash was modulated from the fully closed position to the fully open position for approximately 10 seconds then fully closed while in heating mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The maximum delay in airflow control to 90% of setpoint was approximately 3 seconds.

7A Thermal Override From Cooling to Heating With The Hood Sash Fully Open – Test Failed

Whenever a state change from full cooling to full heating mode was initiated with the hood sash fully closed, there was a brief loss of negative airflow offset within the lab. The test data revealed that the maximum loss of negative airflow was 60 CFM positive for less than 1 second



Issues With Blade Damper – Valve 5 – Butterfly Damper- Digital Airflow Control

Issue

11A – Supply System Failure with Offset Control-Test Failed Whenever a supply system failure was initiated, the lab went extremely negative. Since the space was setup as a negative environment, the supply valve was programmed to track the general exhaust valve to maintain airflow offset to setpoint.

12A - Occupancy Mode Switched from Occupied to Unoccupied– Test Failed Whenever a state change from occupied to unoccupied mode was initiated with the hood sash fully closed, there was a brief loss of negative airflow offset within the lab and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum loss of negative airflow was 50 CFM positive for less than 1 second and the maximum delay in airflow control to 90% of setpoint was approximately 3 seconds.



Issues With Blade Damper – Valve 5 – Butterfly Damper- Digital Airflow Control

Issue

12B– Occupancy Mode Switched from Unoccupied to Occupied– Test Failed Whenever a state change from unoccupied to occupied mode was initiated with the hood sash fully closed, there was a brief loss of negative airflow offset within the lab and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that maximum delay in airflow control to 90% of setpoint was approximately 3 seconds.

14A – Terminal Valve Power Failure– Test Failed

Whenever a terminal valve power failure was initiated, there was a temporary loss of laboratory negative pressure within the lab and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the loss of negative pressure was for about 50 seconds and the maximum delay in airflow control to 90% of setpoint was approximately 60 seconds.



Issue

8C.3 & 8C.4 Minimum Airflow vs ΔP

At an airflow setpoint of 200 CFM, the supply valve exhibited an airflow change greater than five percent of the steady state value whenever the duct static pressure required at the minimum valve differential pressure (DP) of 0.2" WC was increased by 1" WC.

8C.7, 8C.8, 8C.9 Minimum Airflow vs ΔP

At an airflow setpoint of 200 CFM, the general exhaust valve exhibited an airflow change greater than five percent of the steady state value whenever the duct static pressure required at the minimum valve differential pressure (DP) of 0.2" WC was increased by 1" WC.



Issue

2K.4 Airflow Accuracy With Variable Static Pressure

At an airflow setpoint of 1300 CFM, the hood valve exhibited an airflow change greater than five percent of the steady state value whenever the duct static pressure required at the minimum valve differential pressure (DP) of 0.46" WC was increased by 1" WC.

3A Thermal Demand Override to Heating – Test Failed

Whenever a state change from full cooling to full heating mode was initiated with the hood sash fully closed, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum deviation of airflow offset was 550 CFM positive and laboratory pressure was +0.06" WC for less than 3 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 5 seconds.



Issue

4A Hood Sash Change in Heating Mode – Full Closed to Fully Open – Test Failed

Whenever the fume hood sash was modulated from fully closed to fully open while in heating mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the airflow control delay was less than 7 seconds. The lab hood fan speed was increasing to compensate for the sudden change in airflow requirements. Throughout this test, the hood valve command did not go past 90% open.



Issue

4B Hood Sash Change in Heating Mode – Full Open to Fully Closed – Test Failed

Whenever the fume hood sash was modulated from fully open to fully closed while in heating mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum deviation of airflow offset was 550 CFM positive and laboratory pressure was +0.04" WC for less than 3 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 6 seconds. The lab exhaust fan speed was increasing to compensate for the sudden change in airflow requirements. Throughout this test, the exhaust valve command did not go past 90% open.



Issue

5A Demand Override To Cooling - Test Failed

Whenever the thermal demand was switched from full heating to full cooling, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The maximum delay in airflow control to 90% of setpoint was approximately 2 seconds. The lab fan speeds were increasing to compensate for the sudden change in airflow requirements. Throughout this test, the valve commands did not go past 90% open.

6A– Hood Sash Change in Cooling Mode – Full Closed to Fully Open – Test Failed

Whenever the fume hood sash was modulated from fully closed to fully open while in full cooling mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum deviation of airflow offset was 50 CFM positive and laboratory pressure was +0.004" WC for less than 2 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 6 seconds. The lab fan speeds were increasing to compensate for the sudden change in airflow requirements. Throughout this test, the valve commands did not go past 90% open.



Issue

6B - Hood Sash Change in Cooling Mode – Full Open to Fully Closed– Test Failed

Whenever the fume hood sash was modulated from fully open to fully closed while in the full cooling mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum deviation of airflow offset was 350 CFM positive and laboratory pressure was +0.025" WC for less than 3 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 5 seconds. The lab fan speeds were increasing to compensate for the sudden change in airflow requirements. Throughout this test, the valve commands did not go past 90% open.



Issue

6C– Hood Sash Change in Cooling Mode – Fully Closed, 10 Second Delay, Fully Open -Test Failed

Whenever the fume hood sash was modulated from fully closed to fully open for 10 seconds then fully closed while in full cooling mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum deviation of airflow offset was 350 CFM positive and the laboratory pressure was +0.03" WC for less than 3 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 4 seconds. The lab fan speeds were increasing to compensate for the sudden change in airflow requirements. Throughout this test, the valve commands did not go past 90% open.



Issue

7A Thermal Override From Cooling to Heating With The Hood Sash Fully Open – Test Failed

Whenever the thermal demand was switched from full cooling to full heating with the hood sash fully open, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum deviation of airflow offset was 500 CFM positive and the laboratory pressure was +0.04" WC for less than 3 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 4 seconds. The lab fan speeds were increasing to compensate for the sudden change in airflow requirements. Throughout this test, the valve commands did not go past 90% open.



Issue

12A - Occupancy Mode Switched from Occupied to Unoccupied– Test Failed Whenever the occupancy mode was switched from occupied to unoccupied while in full cooling mode, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum deviation of airflow offset was 380 CFM positive and the laboratory pressure was +0.025" WC for less than 2 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 7 seconds. The lab fan speeds were increasing to compensate for the sudden change in airflow requirements. Throughout this test, the valve commands did not go past 90% open.



Issue

12B– Occupancy Mode Switched from Unoccupied to Occupied– Test Failed Whenever the occupancy mode was switched from occupied to unoccupied while in Whenever the occupancy mode was switched from unoccupied to occupied while in full cooling mode, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed the maximum delay in airflow control to 90% of setpoint was approximately 4 seconds. The lab fan speeds were increasing to compensate for the sudden change in airflow requirements. Throughout this test, the valve commands did not go past 90% open.



Issue

12C– Occupancy Mode Switched from Occupied to Unoccupied With an Offset set for -400 CFM– Test Failed

Whenever the occupancy mode was switched from occupied to unoccupied while in full cooling mode with the airflow offset at -400 CFM, there was a brief loss of negative airflow offset within the lab, loss of laboratory negative pressure and the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed that the maximum deviation of airflow offset was 100 CFM positive and the laboratory pressure was +0.01" WC for less than 2 seconds. The maximum delay in airflow control to 90% of setpoint was approximately 3 seconds. The lab fan speeds were increasing to compensate for the sudden change in airflow requirements. Throughout this test, the valve commands did not go past 90% open.



Issue

12D– Occupancy Mode Switched from Unoccupied to Occupied With an Offset set for -400 CFM– Test Failed

Whenever the occupancy mode was switched from unoccupied to occupied mode while in full cooling mode with airflow offset of -400 CFM, the LCS took longer than 1.5 seconds to control the airflow to 90% of setpoint. The test data revealed the maximum delay in airflow control to 90% of setpoint was approximately 4 seconds. The lab fan speeds were increasing to compensate for the sudden change in airflow requirements. Throughout this test, the valve commands did not go past 90% open.

14A – Terminal Valve Power Failure– Test Failed

Whenever the power to the terminal valves and LCS controllers was terminated then restored after 10 seconds, the room pressure and airflow in the lab went positive for about 3 seconds after the power was restored. The parameters such as airflow offset and room temperature setpoint reverted to default values, thus the LCS controlled at different airflow and temperature setpoints once the power was restored. A capacitive reserve or UPS solution on any critical control applications should be considered.



Conclusion

- 1. Generally speaking, venturi systems are faster, but cannot counteract supply and exhaust system failures.
- 2. Systems with direct airflow measurement are slower, but typically control offset more consistently.
- 3. Systems with airflow measurement can better counteract supply and exhaust system failures.
- 4. Long term reliability and maintenance of airflow sensors should be carefully evaluated.
- 5. Control Sequences that have isolation valves should be considered in offset control labs with critical environments.
- 6. Labs requiring a pressure differential and using an offset control that we have discussed may need a pressure sensor to reset the offset.



Questions





This concludes The American Institute of Architects Continuing Education Systems Course

Gaylon Richardson

grichardson@eabcoinc.com

www.eabcoinc.com



