

ADDENDUM NUMBER 1

**PROJECT TITLE: GMIA HVAC System Retro commissioning**  
**Project Address: 5300 South Howell Avenue, Milwaukee, WI.**

Project Number: 5041-11457

Date of Addendum: January 11, 2013

This Addendum to the Contract Documents is issued to modify, explain or correct the original documents, dated December 04, 2012, and is hereby made part of the Contract Documents. Acknowledge receipt of this Addendum in your proposal, or proposal may be rejected.

Please be informed of following clarifications and changes to subject RFP:

1. Proposal due date is being extended to Thursday, January 24,2013 at 2 PM from January 16,2013.
2. Please refer to attached data from planing and partial investigation phase along with GMIA energy consumption. Each concourse has a main meter but AHU's are not individually metered.
3. There are approximately 77 AHU's and 51 Exhaust Fans over 500 CFM.. Main Terminal & concourse E have 31 AHU's out of these 13 AHU's are less than 6000 CFM along with 16 Exhaust Fans. Concourse C & D have 46 AHU's out of these 27 AHU's are less than 6000 CFM along with 35 Exhaust Fans. There is no master list available, however main Metasys panel at Power Plant will list more than 90% of AHU's.  
Minimum of 40% AHU's less than 6000 CFM should be sampled.
4. Second phase of this project can start once owner agrees to measures of implementation for phase one.
5. Consultant will provide a fee breakdown for Audit, Implementation, Verification, Persistence and Ventilation/Pressurization segments for each of two phases. Consultant will not be directly responsible for sub contractors charges for Test & Balancing and Controls work. Owner will add the actual sub contractors charges for Controls and T&B work to the consultant's contract as reimbursable expenses. Consultant will not be allowed any mark up on sub contractor's invoices for Controls and T&B work. The controls coordination work shall be performed either by Johnson Controls as a sub contractor or by maintenance staff.
6. The system cannot be accessed remotely due to security reasons.
7. All AHU's on Metasys system (about 90%) can be trended. About 50% of AHU's have T&B reports and upto date building documentation.JCI cannot provide control logic. JCI feels that even if they provide control logic, no one realistically would be able to interpret that data.
8. About 50% of AHU's have actual sequences of operation.
9. The consultant will schedule to finish Audit segment of both phases by April 15,2013 and submit all cost estimates for implementation and other segments to owner for budget approval. Implementation segment can start tentatively by November 15,2013.

Please be informed that Baggage Claim area and main restaurant area in main terminal are currently under renovation. The HVAC equipment serving these two areas will be excluded from the scope of Retro Commissioning.

I did get a phone call from some of you regarding time frame in item 9 of my email dated 01/11/2013 that consultant will schedule to finish Audit segment of both phases by April 15, 2013 along with cost estimates. If you feel this time frame is too tight then please list the date you can furnish this information in your proposal.

End of Addendum No. 1

**Existing Design Conditions**

There are two main components that determine the air pressurization of any building: (1) outdoor air entering the building via air handling units and make-up louvers and (2) air being exhausted from the building. Airflows such as air consumed by combustion, air infiltrated or exfiltrated due to wind, elevator operation and openings/leakage in the structure can also impact the pressurization of a building.

Exhibit 1 contains design information for the Concourse C, Concourse D, Concourse E and Main Terminal fan system air flows. Included in the tables are design airflows based on original design and renovation drawings. The table provides the design summary of supply air, return/relief air, outside air and exhaust air for each mechanical fan system and net air flow for each concourse. Equipment highlighted in yellow requires further investigation and design condition confirmation.

A summary of the information is included in Table 1 below.

<b>Table 1 Concourse Design Information Summary</b>				
	Concourse C	Concourse D	Concourse E	Main Terminal
Floor Area (sq. ft.)	97,595	201,883	49,527	128,382
Max. Occupancy (people)	3,344	6,217	1,710	4670
Actual Occupancy (people)	2,320	1,530	1,088	--
Design Supply Air (CFM)	110,965	198,760	67,070	179,170
Design Return Air (CFM)	82,685	149,620	54,410	139,385
Design Outside Air (CFM)	28,280	49,140	12,660	39,785
Design Exhaust Air (CFM)	18,078	32,945	7,375	11,380
Net pressurization Air (CFM)	10,202	16,195	5,285	28,405

1. Design data indicates that the Concourse air distribution systems have been designed to maintain a positive pressure. Further evaluation is required to confirm if existing systems are operating at the design parameters.
2. The maximum occupancy levels were calculated based on people densities as outlined in the 2009 International Mechanical Code. These values typically exceed the actual space occupancy.
3. Actual check point occupancy levels were obtained from GMIA. The estimated occupancy level has been calculated based on doubling the maximum two hour occupant window (typically takes place between 5:00 and 6:00 am). This will take into account that people are coming and going through the concourse and terminal.
4. The design outside air quantities meets the requirements ASHRAE standard 62.1-2007 and Wisconsin State Building Code.
5. Evaluation does not include the baggage claim area which is undergoing a renovation in 2012-2013.

#### **Concourse C - Evaluation and Observations**

1. Concourse pressurization has been acceptable.
2. GMIA staff indicated that there appears to be a lack of chilled water availability at the end of C Concourse.
3. The gas burner on the 100% outside air make-up air unit for French Meadows is not working.
4. There is food odor on C concourse. Not all of the exhaust fans appear to be working. Further investigation is required.

#### **Concourse D - Evaluation and Observations**

1. GMIA staff noted that the junction of the Concourse D hammerhead served by AHU-8 does not appear to have sufficient cooling capacity. GMIA staff has concerns that AHU-8, AHU-9 and AHU-10 serving the Concourse D hammerhead have insufficient cooling capacity.
2. Concourse D is served by pneumatically controlled VAV reheat boxes. There is concern that the controls are not operating properly. Further investigation is required.
3. The radiant heat on Concourse D hammerhead has pneumatic controls not controlled with the

- VAV boxes. This may cause some heating and cooling system fighting.
4. The ventilation exhaust fan installed under the Johnny Rockets restaurant renovation project was not operational upon occupancy. The fan has since been made operational. System appears to be operating properly.
  5. Filter maintenance has been a concern for the Concourse D stem roof top units. The rooftop units have differing filter sizes.
  6. The stem rooftop units do not have variable frequency drives. Airflow capacity cannot be modulated.
  7. During the warm summer months, condensate drips from the supply grilles at the high glass areas by gates 27/29. Further investigation of this problem is required.
  8. Hot water cabinet unit heaters serving Level 1 vestibules are not provided with control valves.
  9. At the time of the site visit, the return fan for the south hammerhead AHU-9 was operating at 99.8% speed while supply fan was running at 73% speed. The smoke detectors for the unit were in alarm and the unit was still running. Further investigation is required.
  10. The Concourse D stem does not have active relief control. Gravity relief vents are installed for pressurization control. Relief vents have been capped in some locations and do not appear to be operational. Further investigation is required.
  11. The damper assemblies for the check point rooftop units need repair/replacement.

#### **Concourse E - Evaluation and Observations**

1. GMIA staff noted that the Concourse E rotunda has heating issues when the gate doors are opening and closing. The radiant heat on Concourse E has pneumatic controls. The perimeter heat in the rotunda is not controlled with the VAV reheat boxes.
2. The damper assemblies for the check point rooftop units need repair/replacement.
3. At the time of the site visit, the relief fan for the rotunda AHU-1 was operating at 100% speed while supply fan SF-1 was running at 49% speed and SF-2 was running at 20% speed. The system operation appears to be affecting space pressurization.
4. VAV box controls for the Concourse E rotunda did not appear to be working properly. Further investigation is required.
5. Jet fuel smell is apparent in the E Concourse rotunda.

#### **Main Terminal - Evaluation and Observations**

1. The smoke detector for AHU-19 was in a fire alarm mode. The unit remained on and did not shut down. The supply fan variable frequency drive was running at 100% with the return damper closed and outside air damper open 100%. Access door in the return section was propped open. The heating coil pump was not running. Further investigation on these issues is required.
2. The north relief fan serving the ticketing area in the main terminal has had a surging problem. Further investigation is needed to confirm proper operation.
3. The south relief fan serving the ticketing area in the main terminal was not operating. The air handling units serving the ticketing area should have been in economizer mode and the fan should have been running. Further investigation is needed to confirm proper operation.
4. GMIA is concerned that the heating and cooling operation of the main terminal air handling units AHU-16, AHU-18, AHU-19 and AHU-20 may be fighting each other. Control sequences should be verified. Further investigation is required.
5. The four relief dampers in the main terminal roof do not appear to be working. The operation should be controlled with the outside air damper positions of AHU-16, AHU-18, AHU-19 and AHU-20. Further investigation is needed to confirm proper operation.
6. The supply fan for AHU-1A in the basement of the main terminal was operating at 100% speed

and the relief fan was not running. The AHU should have been running in an economizer mode with the relief fan running. Further investigation is needed to confirm proper operation.

7. Air handling units AHU-12, AHU-13, AHU-14, AHU-15 and AHU-17 located on the southeast mezzanine serving the dining room, meeting rooms, lounge and mezzanine appear to be in poor condition. GMIA should consider replacing these units.

#### **Additional - Evaluation and Observations**

1. The design data does not include the tug tunnel HVAC systems. The tug tunnel is served by two make-up air units sized for a total of 36,000 CFM and associated exhaust fans sized for 40,000 CFM. Airflow testing of the tug tunnel ventilation systems should be considered to confirm proper operation of the systems.
2. The design data does not include the administration building air distribution systems and the baggage claim air distribution systems.
3. GMIA has the following control system concerns and issues.
  - a. Incorrect sequence of operation programming. GMIA lacks confidence in the control system operation.
  - b. GMIA lacks the ability to change set-points and make adjustments to the control system.
  - c. GMIA does not know/understand the control system dead bands.
  - d. Improper sensor calibration has been noted.
  - e. Improper air measuring stations calibration has been noted.
  - f. GMIA does not have the ability to change the unit scheduling and programming.
  - g. System filter alarms are not working.
  - h. GMIA needs to make manual adjustment for vacant areas.
4. The summer ventilation for the walkways between the garage and terminal is served by large exhaust fans and OA dampers/louvers. The outside air dampers are very leaky. Damper replacement with a low leak type damper could be considered.

# EXHIBIT 1

## Air Distribution System Equipment and Airflow Design Summary

Concourse C  
Concourse D  
Concourse E  
Main Terminal











## Executive Summary

General Mitchell International Airport is a large facility that has been built and upgraded in many phases. Due to the nature of an airport, there are many doors open to the outside throughout the course of the day, which affects the comfort and energy use. Based on the utility analysis, the energy use for this facility shows room for potential savings. The retro-commissioning process has two main goals. First, reduce the overall energy use of the facility. Second, address the space pressurization issues at the airport to address passenger comfort. Based on the findings during the planning phase, the retro-commissioning process should continue to help address these issues. Due to the number of units, the savings estimates below relate to approximately 60% of the AHU CFM capacity at the facility. During the investigation phase, the expected savings would be significantly greater.

Table 0-1: Savings Estimates

Category	Category Description	# of Measures	Electric Savings (kWh/yr)	Gas Savings (therms/yr)	Cost Savings (\$/yr)
1	FIMs recommended for immediate implementation	6	357,827	7,146	\$31,304.07
2	Quick Payback <1.5 Yrs	27	400,194	24,817	\$44,264.19
3	Payback greater than 1.5 years and less than 5 years	3	2,060	3,500	\$2,082.59
4	Payback greater than 5 years	0	0	0	\$0.00
Total		36	760,081	35,463	\$77,650.85

### Define the categories

Category 1 FIMs are recommended for immediate implementation and are low/no cost deficiencies that require immediate attention to correct

Category 2 FIMs have a payback of less than 1.5 years. (Immediate FIMs are not included in this list)

Category 3 FIMs have a payback of greater than 1.5 years and less than 5 years.

Category 4 FIMs have a payback of greater than 5 years.

# Common FIM Checklist

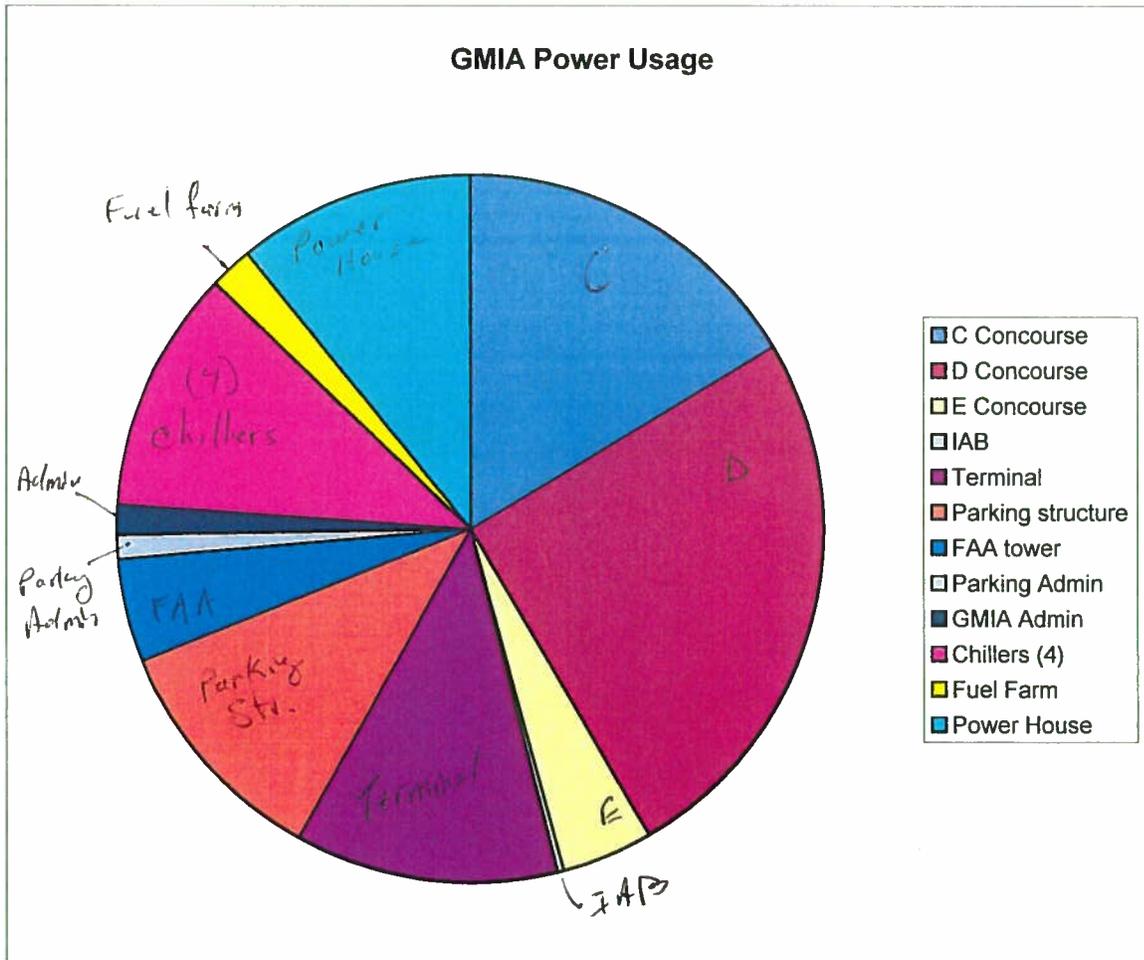
## Appendix C

Retrocommissioning activities must include the investigation of the common FIMS listed below. This is not an all-inclusive list, it is expected that additional deficiencies and related FIMS identified during the RCx Project. HVAC and lighting systems should be investigated to determine if the findings/deficiencies listed below are prevalent in the facility.

Category	Finding	Identified (Yes/No)	Reason not identified
Runtime Reduction	Hours of operation are excessive	Yes	
	Occupancy based controls are not functioning	No	Not relevant
Setpoint Changes	Zone setpoint setup/setback are not implemented or are not optimal	Yes	
	Steam pressure setpoint is sub-optimal	No	Not relevant
	Chilled water supply setpoint is sub-optimal	No	Did not investigate
	Hot water supply setpoint is sub-optimal	Yes	
	Static pressure setpoint is sub-optimal	Yes	
	Supply air temperature setpoint is sub-optimal	Yes	
	VAV box minimum flow setpoint is higher than necessary	Yes	
Controls Resets	Supply air temperature reset is not implemented or is sub-optimal	Yes	
	Condenser water temperature reset is not implemented or is sub-optimal	No	Did not investigate
	Chilled water supply temperature reset is not implemented or is sub-optimal	No	Did not investigate
	Hot water supply temperature reset is not implemented or is sub-optimal	No	Did not investigate
Economizer/Outside Air	Excessive ventilation, minimum OA fraction not set to design or occupant	Yes	
	Economizer operation is sub-optimal	Yes	
Systems Calibration/Maintenance	Simultaneous heating and cooling is excessive	Yes	
	Sensor reading is inaccurate	Yes	
	Valve does not function properly or is not calibrated	Yes	
	Dampers do not function properly or are not calibrated	Yes	

Power usage at GMIA

location	KVA max	percentage	Concourses C,D,E, IAB
C Concourse	1369	16%	46%
D Concourse	2124	25%	
E Concourse	337	4%	
IAB	43	1%	
Terminal	994	12%	
Parking structure	898	11%	
FAA tower	396	5%	
Parking Admin	107	1%	
GMIA Admin	99	1%	
Chillers (4)	948	11%	
Fuel Farm	166	2%	
Power House	899	11%	
<b>total</b>	<b>8380</b>	<b>100%</b>	



7/27/2011

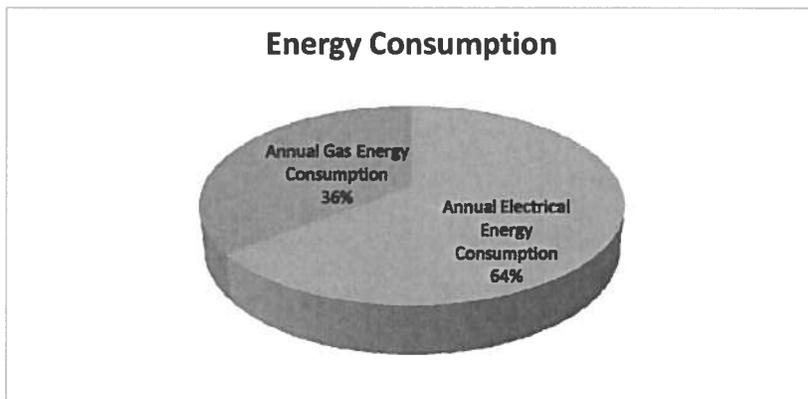
Facility Energy Usage Summary	
Facility Type	Other
Total Floor Area (sq. ft.)	550,000
Total Conditioned Area (sq. ft.)	550,000
Peak kW	
Annual kWh Usage	38,114,156
Annual therm Usage	722,264
Average Cost per kWh	\$0.08
Average Cost per therm	\$0.55
Total Energy Cost	\$3,298,785.03
Facility EUI (kBtu/SF)	367.8
CBECS EUI (kBtu/SF)	115.80
Facility EUI with respect to CBECS EUI	317.62%
ENERGY STAR Benchmark Score	

CBECS Data

Facility Type	EUI
Education	83.1
Healthcare	187.7
Healthcare - Inpatient	249.2
Healthcare - Outpatient	94.6
Public Order and Safety	115.8
Retail (other than mall)	73.9
Office	92.9
Other	164.4

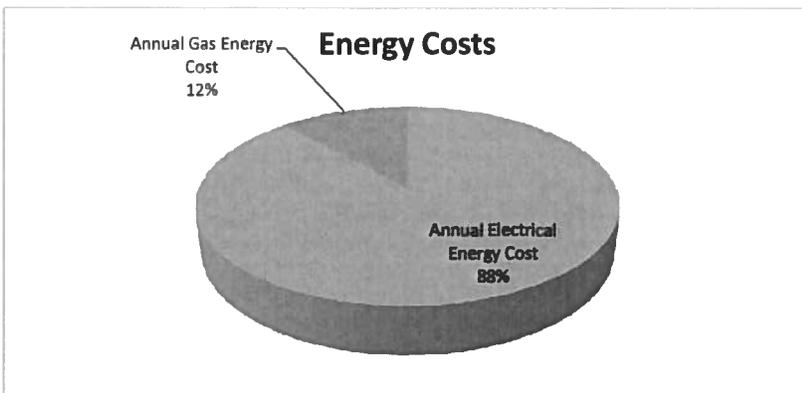
Energy Consumption

Annual Electrical Energy kBtu	130,045,500
Annual Gas Energy kBtu	72,226,400
Annual Total kBtu	202,271,900
Annual Electrical Energy Consumption	64.29%
Annual Gas Energy Consumption	35.71%



Energy Costs

Annual Electrical Energy Cost	\$2,915,101.73
Annual Gas Energy Cost	\$383,683.30
Total Annual Energy Cost	\$3,298,785.03
Annual Electrical Energy Cost	88.37%
Annual Gas Energy Cost	11.63%



Issues Observed that May Affect Energy Use and Indoor Comfort.  
Savings to be Calculated after Systems are Commissioned.

Unit	Date Observed	Issue	Fix
General	2/20/2012	Most Economizer Switchover Set points are at 55F - this is excessively low	Change control Set point
General	2/20/2012	All AHU & RTU & EF run 24/7. Units should utilize schedules to go to reduced flow operation or be shut off when not required.	Add Unit Schedules
C-AHU-8	2/20/2012	Sum of VMA airflows equals 542.9 CFM scheduled CFM is 8450 at full speed. It appears very limited airflow.	Commission Controls
D-A6	2/20/2012	HW valve 100% open - No Heating Occurring	Repair HW Control Valve
D-AHU-8	2/20/2012	Mixed Air Damper viewed as 100% open on control printout. Based on Mixed air temperature only ~ 50% OA to unit.	Verify Damper Operation
D-AHU-9	2/20/2012	Return Fan VFD speed higher than supply Fan. There is OA brought into building, but potentially exhausting more air than necessary affecting space pressurization.	Verify Supply/Return/OA airflows and control sequence
D-AHU-10	2/20/2012	Return Fan VFD speed Higher than supply Fan. There is OA brought into building, but potentially exhausting more air than necessary affecting space pressurization.	Verify Supply/Return/OA airflows and control sequence
D-A7	2/20/2012	Mixed air damper at 91.8% open. OA temp is 37F. Mixed air temperature is 67.9.	Verify Damper Operation
D-A22	2/20/2012	Verified that the dampers are not controlling to the mixed air temperature during economizer operation	Verify Damper Operation
D-RTU-A3	2/20/2012	The mixed air temperature is at 68F. The calculated DA temp is 55.9. The dampers are not economizing correctly. It should also be noted the Mixed air temperature on other units is affected by the heating coil. The heating coil could be leaking.	Verify Damper Operation & HW coil operation
D-RTU-A4	2/20/2012	The Discharge air temperature sensor reads a value lower than the mixed air temperature value.	Calibrate sensors.
E-A1	2/20/2012	Unit not controlling correctly. The Fan speed control not operating as expected. The lower airflow and higher discharge air temperature is causing the East Soffit zone to be too warm due to solar load and the West Soffit to be too cold due to lack of airflow.	Commission Controls
E-AH2	2/20/2012	Relief Fan VFD speed Higher than supply Fan. There is OA brought into building, but potentially exhausting more air than necessary affecting space pressurization.	Verify Supply/Return/OA airflows and control sequence
E-RTU-1 (Continental Express)	2/20/2012	Mixed air Damper commanded 100% open. Based on mixed air temperature unit appears to have OA damper shut	Verify Damper Operation
Main-A1	2/20/2012	Heating valve 100% open and units discharge air temp equals it's mixed air temperature	Verify Control Valve operation
Main-A2	2/20/2012	Heating valve 100% open and units discharge air temp equals it's mixed air temperature	Verify Control Valve operation
Main -A3	2/20/2012	This unit was designed as a single zone VAV system. The supply fan speed was 100% with unit discharging 70F air.	Commission Controls
Main -A10	2/20/2012	This unit was designed as a single zone VAV system. The supply fan speed was 100% with unit discharging 70F air.	Commission Controls

Issues Observed that May Affect Energy Use and Indoor Comfort.  
Savings to be Calculated after Systems are Commissioned.

Unit	Date Observed	Issue	Fix
Main -A11	2/20/2012	HW valve is open but HW pump enable has the pump off. If heating is required, the HW pump should be enabled.	Update control set point
Main - A13	2/20/2012	Mixed air dampers are commanded 100% open. The mixed air temperature is equal to the return air temperature.	Verify Damper Operation
Main - A14	2/20/2012	Mixed air dampers are commanded 100% open. The mixed air temperature is equal to the return air temperature.	Verify Damper Operation
Main - A15	2/20/2012	Mixed air dampers are commanded ~50% open. The mixed air temperature is close to the return air temperature.	Verify Damper Operation
Main -A16	2/20/2012	This unit was designed as a single zone VAV system. The supply fan speed was 100% with unit discharging 70F air.	Commission Controls