DESIGN DAY
MECHANICALS INC

October 4, 2012

Superintendent of School
SAU 15
90 Farmer Road
Hookset, NH

Attn: Karen Lessard

Auburn Village School Ventilation airflow measurements

The following report is based on the HVAC System Test Report provided by EES HVAC Test and Balance Services.

The majority the report shows the CFM values at each diffuser or grille in the space. Since the report did not have page numbers I have added them myself, with the cover sheet being page 1, with the last page being numbered 13. On page 2 and 3 there are specific issues that the balancing contractor has made a note of. I will note these separately below and comment specifically on each one.

Issue #1-on my original plans, from which the balancer did his work, I'd assume that the Guidance Office was part of the Front Office's air-conditioning system. This issue reports that it has its own air handling system.

Issue #2-the balancer was noting an omission of an exhaust grille on my plans and comments on the ERV system that it is part of. Further in the document he does provide airflow numbers for Room 111 and Room 109.

Issue #3-these "transfer grilles" were noted during my walk-through of the building. I assumed they were some type of transfer from either the corridor into the class or from the class out to the corridor. These grilles and associated ductwork might've been part of a system that was in the room before. The fact that there is no air flowing through these grilles does not raise concern with me.

Issue #4-I believe I had originally noted in a previous report that these units were not operating. There is a switch on the side of the unit above the ceiling that turns the unit on and off. During my site visit they were off. I did operate the switch to see if motor would operate, which it did. If these spaces are to be used as locker/toilet/shower rooms, an additional switch should be put on the wall to allow operation by manually turning on the switch during time of use (which would then require someone to remember to turn them off), or provide a motion sensor switch with a timed delay shutdown. It is also possible to put these units on a time clock. But if they are not used at all during the day this may not be the best solution.

Issue #5-this obviously requires that the outside air intake louver is be cleaned. Once they are cleaned they should be checked periodically. The larger issue with this system is that there are no operational controls that monitor the outside air intake flow and the return airflow. For proper ventilation of the space, the system will need to be overhauled. There are now pneumatic controls in place to operate the air handler dampers, but no compressor in the school to provide the required compressed air to operate these controls. I've noted before that control of these dampers was suspect. It appears now that the return air damper and the outside air damper were placed in a set position and are not automatically adjustable by space controls. If the monies can be found I would recommend that control of the outside air brought into the space be done with a CO_2 sensor. I'd previously noted this information on the floor plan drawings provided in the bid documents

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You can see from the report that one unit is only being in 178 CFM of outside air (OA) and the other unit is not bringing in any. This amount of 0A is not sufficient for this type of space. This space measures approximately 4800 ft.² without including the stage. The current international mechanical code 2009 would require that this space, which could be considered a multiuse assembly would require 7.5 CFM per person and .06 CFM ft.² . The code also notes that spaces such as this be considered to be able to hold 100 people per 1000 ft.² .This would be 480 people. This number times 7.5 CFM/person is 3600 CFM of outside air. The square footage of the space would require another 288 CFM. It is suggested that in HVAC engineer be brought in to determine the heating load of the space. The system then should be set up to follow these guidelines.

Issue #6-this is just reporting a missing diffuser on my plans.

Issue #7-this is noting that the bathroom exhaust outside the cafeteria is not operating. Since this report the facilities manager noted that he had gone up on the roof and that the motor on this fan is burned out and a new part has been ordered.

Issue #8-the balancer was able to locate the grille as he noted and did get airflow readings for both the supply and return.

Issue #9-this reports that the ERV is not operating, so therefore no outside air is being brought into the space. This unit needs to be looked at and fixed or replaced.

Issue #10-these toilet rooms were on the same fan system as noted in issue #7 above. By fixing issue #7, this issue will be resolved.

Issue #11-we see that rooms 204 and 202 are providing supply and return as shown on the plans. The reason it is done this way is that a corridor as well as other spaces all require ventilation. So by supplying all the necessary outside air for the corridor and the classrooms we're ventilating the corridor first with more outside air that is necessary and then bringing it through the classrooms to complete the ventilation circuit. Also exhausting through the rooms and supplying in the corridor prevents the transfer of smoke or fumes from a classroom into a space that students may be using as an exit path. Therefore the ductwork in rooms 212/210/208/206 should be reversed. This can be done above ceiling right at the location of the ERV.

Issue #12-as the note says there is no outside air brought into the computer room from ER –3. I was told that the space was once open to the classroom next to it, but it's since been changed. To correct this you can modify the ductwork from the adjacent classroom and ERV–3 or you can connect the air-conditioning system to outside air. If connected to the air conditioner the fan will need to run continuously, even though cooling is not required, to bring in the outside air.

The rest of the report deals with the airflows in the spaces. On page 4, M-1 through M-3 are your modular classrooms. The type of unit in these classrooms has a direct connection to the outside air so it is hard to separate what is outside air from the total air delivered into the space. It is my understanding that the outside dampers that are part of this package system were open allowing fresh air to mix into the tempered return air.

Page 5 and 6 list the portable classroom units. These also have a packaged unit with outside air, return air and supply air that are all interconnected. Once again it is my understanding that the outside air portion of these units was open.

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On page 7 we move into the main part of the school building. This has listed the supply and return air from ERV-1 .As can be seen here this unit is supplying 2200 CFM and only returning 278 CFM. It was verbally reported to me that the exhaust grilles in the small toilet rooms that are part of each of these classrooms are not connected to the ERV. Therefore these toilet rooms have no ventilation air/exhaust air. As mentioned before toilet room ventilation is something that should be corrected as soon as possible.

On page 8 the guidance office air handler and the main office air handler are listed. The guidance office air handler seems well-balanced in that it is within the usual tolerance of a 10% difference between a balance supply and return. The main office is off by about 20%. What is not known is the actual values that these systems require for the tonnage. If both of these spaces have 1 ton air conditioners than the CFM values are quite acceptable. If there have been issues of the air-conditioning coils freezing in these units than the airflow amounts should be changed. As I still understand it, there is no fresh air connection to the office air handler.

Page 9 and10 deal with the small ERV's that are for the single classrooms only. As you can see most of these units are supposed to provide 200 CFM of outside air and none of them are providing this amount. The 2009 International Mechanical Code is the current mechanical code for the state of NH. Ventilation values for classrooms and an elementary school require 10 CFM per person in the room and .12 CFM per square foot.

The two kindergarten rooms are relatively new units. These units are similar to the portable and modular classrooms were outside air is mixed with return and supply air.

ERV-2 on page 11 is listed to supply various rooms, seems to be fairly closely balance. What is not known is the actual values that the system was sized for.

Earlier in this document I already discussed the gym units. Still on page 11 is a cafeteria unit and obviously something needs to be looked at to try to understand the differences between 6000 CFM supply 1100 CFM supply.

Moving on to page 12 there is a list numerous single classrooms and their associated ERV. As has been documented the designed airflow have not been recorded. For ERV-3 the supply is listed at 1099 CFM. The return numbers do not added up to this amount. In fact they add up to less than half the supply CFM. In situations like this it could be duct leakage that allows ERV exhaust to grab air from other places then the grilles.

During our conference call on October 1, the question was asked about ways that the school might be able to improve airflow and the classrooms through these existing small ERV's. I will reiterate this letter some of the comments I made then.

As with the gym units the ceiling mounted ERV's in the classrooms have outside air connections. If there were any types of blockage in the air vents, like a wasp nest, it would be like using a partially blocked drinking straw. The blockage would require the unit to use extra power to draw air through all the ductwork. The unit is not sized with the motor capable of this in the airflow will be reduced. I understand that some of these units have been replaced over the years so there are some newer models operating at the school. I believe that the airflow testing was scheduled to be done in August after the regular scheduled filter change out for these units. Something I've learned recently about this type of ERV system is that the internal cores that exchange the air can also become clogged up with particles to get through the filters.

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Another thing that can be looked at is the ductwork runs that are connected to these ERVs. If there are excessive number of elbows, crimps in the flexible piping, crimps at the diffuser or grille connections or long runs a flexible ductwork, all of these things can contribute to additional friction to airflow movement in the system.

I would recommend that before a large program is begun to remove these systems, I would select one or two, review the installation that was done above the ceiling, make any adjustments to shorten duct runs, make sure the louvers are free and clear and then test them for airflow again. But before all that is done a test for the unit with minimal or no ductwork connections should be tried to see what the maximum airflow you can get out of the unit is.

Respectfully,

John Waitt, for Design Day mechanical, Inc.

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