

# **PROPOSAL FOR REVIEW AND COMMENT**

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SUBMITTED TO  
MINNESOTA DEPARTMENT OF  
EDUCATION

INDEPENDENT SCHOOL DISTRICT NO. 831  
FORST LAKE AREA SCHOOLS  
6100 N. 201TH ST.  
FOREST LAKE, MINNESOTA 55025

JULY 20, 2012



**DLR Group**

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DLR GROUP 40-12120-00



**FOREST LAKE AREA SCHOOLS**

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(651) 982-8100 • [www.flaschools.org](http://www.flaschools.org)

*Superintendent.....Dr. Linda M. Madsen*  
*Administration & Human Resources.....Donna M. Friedmann*  
*Business Services.....Lawrence A. Martini*  
*Community Education.....Julie A. Ohman*  
*Special Education.....Deborah A. Wall*  
*Teaching & Learning.....Jennifer S. Tolzmann*

July 20, 2012

Commissioner Brenda Cassellius  
Commissioner of Education Minnesota  
Department of Education  
1500 Highway 36 West  
Roseville, Minnesota 55113

Subject: Proposal for Review and Comment for ISD No. 831

Dear Commissioner Cassellius:

In accordance with Minnesota Statute 123B.57 and 123B.59, the School Board of Independent School District No. 831 submits the following Health and Safety Improvement proposal for review and comment.

Specific details regarding the project are included in the enclosed proposal for review and comment.

The School Board approved the submission of the enclosed Review and Comment.

Thank you in advance for your cooperation and we look forward to your response.

Sincerely,

Linda M. Madsen  
Superintendent

LMM:db

*Inspire the learner; ignite the potential!*

*Forest Lake Area Schools Independent School District 831 Equal Opportunity Employer*

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## **INTRODUCTION**

In accordance with Minnesota Statute 123B.71 (2000), the School Board submits the following educational facility proposal for review and comment. The specific data is as follows:

Identification:           **Independent School District No. 831**  
Forest Lake Area Schools  
6100 N. 210<sup>th</sup> Street  
Forest Lake, MN 55025  
Contact: Larry Martini, Director of Business Services  
Phone: 651/982-8125  
Fax:   651/982-8135

School Board:           Rob Rapheal, President  
Erin Turner, Vice President  
Karen Morehead, Clerk  
Dan Kieger, Treasurer  
Kathy Bystrom, Director  
Julie Corcoran, Director  
Gail Theisen, Director

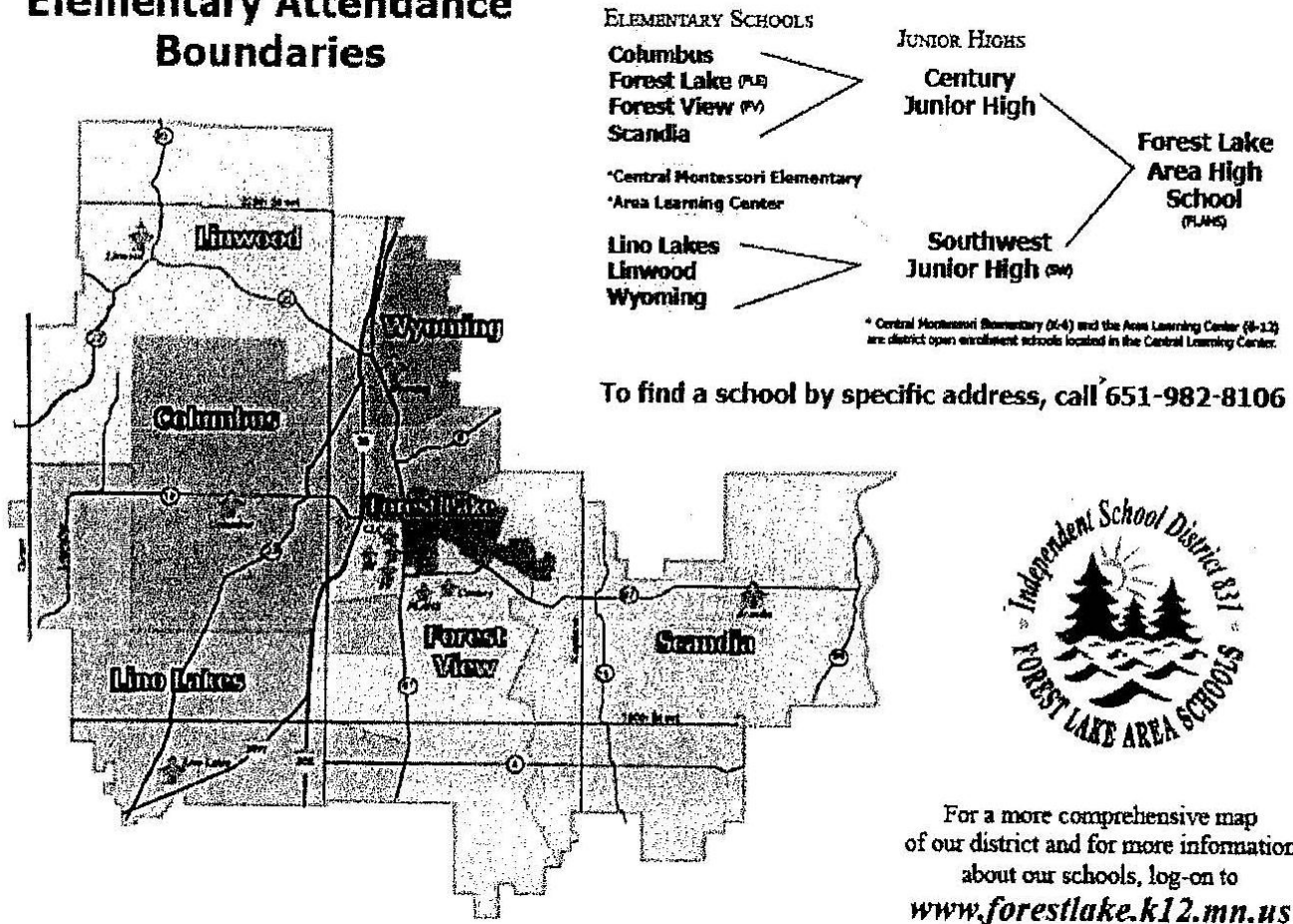
Architect/Engineer:   **Lee A. Meyer, Architect**  
                                 **Don Horkey, Engineer**  
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[dhorkey@dlrgroup.com](mailto:dhorkey@dlrgroup.com)



## 1. GEOGRAPHICAL AREA AND STUDENT POPULATION

The Forest Lake Area School district is located Northeast of the Twin Cities and is shown on the map below.

### *Forest Lake Area Schools* **Elementary Attendance Boundaries**



The Forest Lake Area School District serves students in northern Washington County, eastern Anoka County and southern Chisago County with 60 percent of the district's households in Washington County. This area of the Twin Cities Metropolitan Area is still a developing area. However, K-12 public school enrollment peaked in the Forest Lake School District in Fall 1996, when 7,864 K-12 students were enrolled. The municipalities served by the Forest Lake Area School district include all or portions of the cities of Columbus, East Bethel, Forest Lake, Ham Lake, Hugo, Lino Lakes and Wyoming. The district also serves residents from Linwood Township, May Township, New Scandia Township and Wyoming Township.

The district serves a total population of 47,548 within an area of over 240 square miles. The school district is surrounded by the Anoka Hennepin, Franconia, Cambridge-Isanti, Centennial, Chisago Lakes, Mahtomedi, North Branch, St. Francis, Stillwater and White Bear Lake school districts.

**1A. K THROUGH 12 STUDENT ENROLLMENT FOR THE PAST FIVE YEARS**

This data is from Fall Enrollment as tracked by the school district.

GRADES	YEAR						
	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
K	482	482	490	522	478	523	443
1	510	503	480	510	510	489	528
2	519	480	490	478	504	516	483
3	527	503	513	506	470	512	527
4	521	534	501	521	502	474	503
5	580	518	536	495	511	480	460
6	541	553	496	533	474	494	473
7	565	556	588	509	538	542	581
8	607	544	570	595	506	529	535
9	635	590	535	575	568	497	529
10	627	681	629	544	575	574	500
11	661	633	651	610	538	555	552
12	661	679	627	639	606	584	563
<b>TOTAL K-12</b>	7,436	7,256	7,106	7,037	6,780	6769	6677

**1B. STUDENT ENROLLMENT PROJECTIONS FOR THE NEXT FIVE YEARS**

This is Fall Enrollment data that was developed by Hazel Reinhardt Consulting Services.

GRADES	YEAR				
	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
K	499	503	508	503	500
1	499	504	508	504	502
2	485	489	494	488	488
3	493	490	494	489	489
4	503	498	495	498	498
5	485	503	498	503	503
6	458	460	478	460	460
7	496	476	479	476	476
8	516	496	476	476	476
9	496	516	496	479	479
10	561	526	547	500	488
11	548	561	526	530	525
12	639	559	573	560	530
<b>TOTAL K-12</b>	6,677	6,581	6,570	6466	6414

## 2. LISTING OF EXISTING SCHOOL FACILITIES

The students are presently organized in the schools as shown in the chart below. The District has reviewed the availability other facilities both within the District and outside the District. No other facilities of significant size have been identified to be available for use by the District either in the District or in adjacent school districts.

<u>Building</u>	<u>Square Footage</u>	<u>Year Built</u>	<u>Program</u>	<u>Number of Students (Fall 2011)</u>	<u>Capacity</u>	<u>Acres</u>
Columbus Elementary	71,867	1975	K-6	471	600	29.8
Forest Lake Intermediate	66,380	1957	4-6	364	525	64 *
Forest View Primary	87,155	1967	K-3	553	700	64 *
Lino Lakes Elementary	77,110	1957	K-6	408	650	20.0
Linwood Elementary	68,372	1961	K-6	469	625	20.3
Scandia Elementary	62,807	1962	K-6	426	525	28.8
Wyoming Elementary	86,187	1989	K-6	623	750	21.1
Central Montessori @ CLC**	132,886	1948	K-6	102	200	64 *
Century Junior High	159,942	2000	7-9	893	1,150	70
Southwest Junior High	146,772	1964	7-9	744	900	17.9
Jr. ALC @ CLC**				8		
Forest Lake High School	321,824	1972	10-12	1562	1,800	58.1
Sr. ALC @ CLC**				53		
<b>TOTAL</b>				6,676		

\* Three School Campus of 64 Acres

\*

\*\* CLC – Central Learning Center which houses a number of programs

\*\*

### **3. SPECIFIC DEFICIENCIES AND BENEFITS**

#### **3A. DEFICIENCIES**

DLR Group has completed an evaluation of the Forest Lake High School Building mechanical systems. The purpose of the evaluation was to determine the ventilation rates available to the occupants by the existing ventilation systems. A certified balancing technician completed the quantitative readings of the existing ventilation system's performance.

The actual existing system ventilation rates are found in the tables of this report. The existing heating ventilating equipment do not have the capacity to provide the required ventilation rates for occupants as established by the ASHRAE 62 standards in all seasons of the year.

All elements of the ventilation system are not code compliant to the latest Minnesota State Codes.

The ventilation system that is being considered for this project consists of (4) steam fired air handling units. All of this equipment has out lived their useful life for effective ventilation. With no exceptions the air handling equipment does not provide the filtration recommended for schools per 123B.72. The equipment is currently fitted with 20% efficient filters the minimum requirement per ASHRAE is 65%.

None of the major ventilation control systems are capable of controlling and monitoring the volume of outside air. The major control devices are beyond repair and must be replaced.

These facts are causing significant occupant complaints from the occupants of the Forest Lake High School that the Forest Lake School District would like to resolve with a Ventilation upgrade project.

#### **3B. BENEFITS**

The primary benefit of the project will be the significant improvement in the Indoor Air Quality of the facility. Numerous research studies have shown the correlation between good indoor air quality and the reduction in student and faculty absenteeism and the improvement in student performance. The project consists of demolition of the existing outdated air handling equipment components and replacing the equipment with components capable of providing the design ventilation rates. The existing DDC control logic systems will be expanded to include the new mechanical equipment and systems.

A side benefit to the project will be the overall reduction in operational and maintenance cost for the facility. This will enable the District to allocate more of their general funds to instruction and less to operation and maintenance.

The project will include commissioning of the new mechanical installations and systems to ensure system performance.

#### **4. RELATIONSHIP OF THE PROJECT TO ANY PRIORITIES**

Forest Lake Area Schools understand the importance of safe, secure, well-maintained facilities, and good indoor air quality to the health, happiness and performance of students and faculty alike. The District is committed to providing an educational environment that allows teachers and learners to succeed. The improvements included in this proposed project will allow the quality of the educational environment to be preserved and enhanced. This project is consistent with the School District's Strategic Plan stated below:

#### **Strategic Plan: Mission and Beliefs**

##### **BELIEFS:**

*We believe that ...*

- Every person has intrinsic value.
- All people deserve to be treated with respect.
- All people have unlimited potential to learn.
- Honesty and trust are critical for building community.
- Every person has a responsibility to contribute positively to their community.
- The community benefits from individual uniqueness because it brings forth new and better ideas.
- All people need a safe environment, with caring and supportive networks, to thrive and prosper.
- Personal success requires hard work and persistent effort.
- The strength of any public organization is dependent on the level of community ownership.
- A public education system is essential to a vibrant and thriving community.

##### **PARAMETERS:**

We will always strive to ensure our community understands major school initiatives. We will continually review proposed and existing programs and policies to ensure they support our strategic plan

##### **MISSION:**

The mission of the Forest Lake Area Schools, the innovative leader of a community engaged in learning, is to develop individuals who excel in, and contribute to, a dynamic global society, which will be accomplished by: Attracting and retaining the best and brightest staff; Integrating technology seamlessly; Fostering interactive partnerships with parents; Challenging students at all levels, and; Inspiring students to be actively engaged in meaningful lifelong learning experiences. OBJECTIVES: 100 percent of Forest Lake area students will achieve in the top 25 percent of a nationally/user normed test. 100 percent of our students who take the ACT will score above the ACT College Readiness Benchmark Scores. 100 percent of our students will understand their connections to the global community. 100 percent of our students will pursue formal education or training after graduation. 100 percent of our students have the motivation and confidence to attain their personal goals. 100 percent of our students will participate in the election process. 100 percent of our students will annually participate in voluntary service activities.

**STRATEGIES:**

- I. We will instill in all staff and students an understanding of all cultures.
- II. We will ensure that all staff are highly skilled, motivated, and provide positive and challenging learning environments for all students.
- III. We will partner with parents to enhance their involvement in the educational process.
- IV. We will develop a change process that addresses the concerns of all stakeholders.
- V. We will engage the entire community to be active participants in the educational process.
- VI. We will develop and implement a process to constantly review our facilities and technology to ensure they support our strategic plan.
- VII. We will develop a system of internal and external communication that educates the entire community on what is happening throughout the organization.
- VIII. We will ensure all curricula, instruction and extra-curricular activities challenge and motivate students at all levels.
- IX. We will energize all systems to promote physical, emotional and social well-being of all staff and students.

**5. ACCESS TO SCHOOLS**

Forest Lake Area Schools understand the importance of safe, secure, well-maintained facilities, and good indoor air quality to the health, happiness and performance of students and faculty alike. The District is committed to providing an educational environment that allows teachers and learners to succeed. The improvements included in this proposed project will allow the quality of the educational environment to be preserved and enhanced in Forest Lake and is one of the District's highest priorities.

**6. Collaboration**

Forest Lake Area Schools are involved with a very large number of collaborative projects with both government and nonprofit entities. Facility improvements will enhance opportunities for collaboration by allowing more economical use of partially occupied facilities and by preserving the healthy secure environment that building users have come to expect.

## **7. NARRATIVE DESCRIPTION OF THE PROJECT**

A description of the ventilation improvements, specifications, budget and preliminary floor plan is included in Appendix A.

The proposed schedule is as follows:

### **Phase I**

July 19, 2012:	School board approval of Review and Comment for submission
September 2012:	MDE approval
December 2012- February 2013:	Design and construction documents
March 2013:	Bidding
April – June 2013:	Construction

### **Phase II**

July – August 2013:	Construction
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## **8. FINANCING**

On July 19, 2012 the Forest Lake Area Schools School board made a recommendation to submit a request for Alternative Bonding to enable the District to move forward with this project. The District intends to use their local levy authority to fund these projects on a pay as you go basis.

## **9. OPERATING BUDGET IMPACT AND ANALYSIS**

DLR Group, the architectural and engineering consultants for the District, projects that the operating costs of the upgraded building mechanical and electrical systems will increase slightly depending on utility rates. Despite increases in ventilation rates in many portions of the facility, there will be offsetting efficiency improvements that will assist in reducing these operational increases.

## **10. SCHOOL SITE ROAD ACCESS AND SAFETY**

The proposed projects will maintain the current District practices for safe school site road access. This IAQ project will not change any current school access configurations.

## **11. AIR QUALITY ISSUES ADDRESSED/LIABILITY INSURANCE**

### **Air Quality Issues**

All proposed renovations would be designed to comply with indoor air quality regulations in effect at the time design began. Indoor air quality improvement is the motivation for the scope of this project.

### **Liability Insurance**

DLR Group has professional liability insurance coverage. A Certificate of Insurance is available if requested.

I hereby certify that DLR Group has professional liability insurance coverage.

**DLR Group**



Lee A. Meyer  
Minnesota Registration #19356

## **12. HVAC CODE STANDARDS**

DLR Group certifies that within the prevailing standard of care as practiced in Minnesota, the design for the new facility's heating, ventilation and dehumidification systems will meet or exceed applicable codes, and standards will provide for the monitoring of outdoor airflow and total airflow of ventilation systems, and will provide an indoor air quality filtration system that meets codes.

**DLR Group**



Lee A. Meyer  
Minnesota Registration #19356

## **13. DESEGREGATION REQUIREMENTS**

Desegregation requirements for this community have not been identified as a problem. Forest Lake Area Schools is an equal opportunity district and is in compliance with all requirements pertaining to human and civil rights. Forest Lake Area Schools is not operating under any court ordered desegregation plan.



## **14. SUSTAINABLE DESIGN CONCEPTS**

Major components of equipment and materials used for the project will be environmentally sustainable and increase energy efficiency; provide an environmentally healthy building and reflect the best lifecycle value rather than the least front-end cost. This is standard practice for all of the Forest Lake Area School District's proposed project.

The replacement of outdated control systems with newer systems that will allow monitoring and evaluation of system performance will ensure appropriate ventilation for today's standards.

Occupational health safety and comfort will be given the highest importance and are in fact, the motivation for this work.

## **15. ACOUSTICAL DESIGN CONCEPTS**

The Architects and Engineers will consider the American National Standards Institute S12.60 Classroom Acoustics Standards in the design of the improvements for maximum background noise levels and reverberation times.

## **16. CUMULATIVE COSTS TO PROVIDE INFRASTRUCTURE**

The proposed renovations will make use of existing utilities and sewer, infrastructure and any and all modifications of these services is included in the project budget with no cost to other units of government.

**ATTACHMENT 7**  
**PRELIMINARY FLOOR PLAN**  
**ATTACHMENT 8**  
**TEST AND BALANCE REPORT**  
**MECHANICAL SYSTEMS INDOOR AIR QUALITY STUDY**

## Attachment 7

**Part A (HVAC)** -- The purpose of this form is to provide the CFL/MDE with sufficient information for a Mechanical Ventilation Health and Safety project to be approved with at least a "PPA" designator (Provisional Project Approval) if not a "YES." A "PPA" approval will maintain levy authority for the district until November 9, 2012. If the remainder of information has not been received by this date, approval will revert to "NMI" (Needs More Information) and levy authority will be rescinded. Please complete all requested information.  
**Forms to be completed by an architect or engineer (PE) only.**

Project description	<p><b>What is the reason for the work (shortcomings of any existing system)? What is the work? Upgrade or replace?</b></p> <p>The project involves one building – Forest Lake High School.</p> <p>The intent of this project is to replace, update and remediation of the existing ventilation systems to restore the quality of indoor air to a safe level. This is accomplished by means of new heating and ventilation equipment and duct and piping distribution system modifications. The project design upgrades the ventilation systems to provide the ventilation rates as required by the Minnesota Mechanical Code and ASHRAE 62 of between 15 to 30 CFM per occupant as determined by the space use and occupancy.</p> <p>The ventilation rates will be increased to 15 CFM for classrooms and 20 CFM for offices as required by the ASHRAE standards.</p> <p>The project will eliminate the potential sources of contamination of the ventilation air by strategic placement of outside air intakes.</p> <p>The project will replace the existing deficient air handling system with components that provide the proper air quality and dehumidification for the school occupants. This project extends functionally to the new units only and is consistent with the Health and Safety qualifying criteria. The project will be commissioned to assure that the design intent has been properly executed.</p>
Project Workscope	<p><b>What major functions (capabilities) will the new system incorporate? (Airflow, humidity control, DDC, filtration) Which are funded under non-H&amp;S funding source? Will there be co-function or integration (e.g. energy savings or performance contracts)? INCLUDE THE IAQ EXCLUSION STATEMENT FOUND IN ATTACHMENT 8 OF THIS LETTER.</b></p> <p>The project consists of demolition of the existing outdated air handling equipment and replacing the equipment with systems capable of providing the design ventilation rates. The replacement of the mechanical system components will require incidental architectural and structural element modifications that are required to complete the mechanical installations. The existing DDC control logic systems will be expanded to include the new mechanical equipment and systems.</p> <p>Included in this work is the replacement of the ventilation systems in classrooms, and media center. New air handling units that will provide tempered air via ductwork capable of providing the required ventilation rates and filtration. These new systems will provide the proper required ventilation for the occupants.</p> <p>The project will include installation of new supply and exhaust duct distribution to spaces that are not presently ventilated at appropriate levels. The exhaust systems will be brought to current code requirements. Spaces that contain cleaning chemical that are currently not properly ventilated will be fitted with exhaust and supply air.</p> <p>The existing building automation systems will be expanded to accept the new equipment and control functions required to properly ventilate the building.</p> <p>The project will include commissioning of the new mechanical installations and systems.</p> <p>There are no outside funding sources for these projects.</p>
Rooms/ Areas affected by the work	<p><b>Description of functions (e.g. classroom, labs, shops, commons area, administrative area). Any special needs? (E.g. special ed, disabled, high loading, building or community concerns)</b></p> <p>The project will correct the deficiencies in the ventilation systems for High School. The spaces addressed in this project are the classrooms, and media center.</p>

Attachment 7

Existing system description	<p><b>Current capacity in CFM/person for each area. Other capacity (e.g. air conditioning, humidity, high filtration, swimming pools, co-location with community/other functions)</b></p> <p>Please see the Mechanical Systems Indoor Air Quality Study dated July 19, 2012. This reflects the testing that has been completed on each of the existing mechanical units and reflects the existing CFM/person for each area.</p>
Design Criteria	<p><b>Outcomes. To include airflow rate, humidification, dehumidification, air filtration, outdoor temperature range, indoor temperature and humidity ranges.</b></p> <p>The project intent is to increase the ventilation rates to 15 CFM per occupant for classrooms, 20 CFM per occupant for offices and 30 CFM for lockers occupant. These rates are as required by ASHRAE 62 standards.</p> <p>The systems will be designed to be compliant to the latest Minnesota Mechanical code and ASHRAE standards.</p> <p>Dehumidification will be incorporated into the design to maintain indoor conditions at 74 deg. F with 50% relative humidity. Air filtration will meet or exceed Minnesota requirements.</p>
Building 81/2 X11 Diagram	<p><b>Shows function and per-room capacity of areas affected by the work.</b></p> <p>Please see the Mechanical Systems Indoor Air Quality Study dated July 19, 2012. This reflects the testing that has been completed on each of the existing mechanical units in the building and reflects the CFM/person for each area.</p>
Cost	<p><b>Total cost, cost per year, whether bond or levy (more info needed if bonding)</b></p> <p>Please see the cost estimate included in the Mechanical Systems Indoor Air Quality Study dated July 19, 2012. This reflects the costs necessary to update the existing system to comply with today's mechanical codes.</p>

**Part B (HVAC)** - The purpose of this second form is to provide the remainder of information needed for project approval, or for conversion of approval form "PPA" to "YES." The information requested should reach the CFL/MDE in time for approval by November 1, 2005. Information received after this date risks conversion to "NMI" status. Note: Neither Part A (above) nor Part B (below) requires that an actual engineering design have occurred. Forms provide the MDE with sufficient information without requiring that the engineering design be accomplished to justify the funding of the project under H&S **to be completed by architect or engineer (PE).**

Document Current Capacity	<p><b>Provide "proof" of current system capacity (e.g. measurement, detailed calculation, sampling)</b></p> <p>Please see the Mechanical Systems Indoor Air Quality Study dated July 19, 2012. This reflects the testing that has been completed on each of the existing mechanical units in each of the buildings and reflects the CFM/person for each area.</p>
System Component Information	<p><b>Major components, which are affected by the work. Indicate which are upgrade, replacement or if the entire system is to be replaced.</b></p> <p>Please see the Mechanical Systems Indoor Air Quality Study dated July 19, 2012, for information regarding the functioning of the new equipment being installed.</p>
Line Diagram	<p><b>8 1/2 X 11 floor plan showing boxes and lines where major functions are to be located and air flow pathways.</b></p> <p>Please see attached plans of the building indicating the location of the major mechanical unit and the airflow pattern of each typical layout.</p>
Part A Revised	<p><b>Corrected, updated copy of Part A (HVAC)</b></p>

## Attachment 7

**Part A (Mold)** - The purpose of this form is to provide the MDE with sufficient information for a Mold Abatement Health and Safety project to be approved with at least a "PPA" designator (Provisional Project Approval) if not a "YES." A "PPA" approval will maintain levy authority for the district until November 9, 2007. If the remainder of information has not been received by this date, approval will revert to "NMI" (Needs More Information) and levy authority will be rescinded. Please complete all requested information. **Forms to be completed by architect, engineer (PE) or CIH only.**

Project description	What is the reason for the work? What is the work? How is it affecting students/employees (present and potential future)?  N/A
Water or moisture source	From where is the water or moisture coming from? (E.g. elevated and uncontrollable humidity, sealed area, walls, windows, pipe burst)  N/A
Building Materials Impacted	E.g. walls, roof, windows, flooring, drop ceiling? Regardless of whether funded or not funded by H&S.  N/A
Scope of work to abate the hazard	What methods and procedures will be employed? What safeguards will be invoked?  N/A
Rooms/ Areas affected by the work	Description of functions (e.g. classroom, labs, shops, commons area, administrative area). Any special needs? (E.g. special ed, disabled, high loading, building or community concerns). Include an 8 1/2 by 11 floor plan drawing showing extent of water damage. Indicate type of damaged materials (E.g. walls, flooring, ceiling).  N/A
Water or moisture abatement plan	Is there a plan to fix the water or moisture problem? How do you plan to fix the water or moisture problem? What is your source of funding and time schedule?  N/A
Cost to fix	Total cost of H&S and non-H&S. Include funding sources planned (e.g. H&S, Operating capital, referendum).  N/A

## Attachment 7

**Part B (Mold)** - The purpose of this second form is to provide the remainder of information needed for project approval, or for conversion of approval form "PPA" to "YES." The information requested should reach the MDE in time for approval by November 1, 2005. Information received after this date risks conversion to "NMI" status. Note: Neither Part A (above) nor Part B (below) requires that an actual engineering design have occurred. The purpose of these forms is to provide the MDE with sufficient information without requiring that the engineering design be accomplished to justify the funding of the project under H&S. **Forms to be completed by architect, engineer (PE) or CIH only.**

Building Floor Plan	Floor plan indicating damaged areas and digital photo prints linked to the diagram.  N/A
Details of Moisture Problem	Quantification of moisture problem. Forensic evaluation.  N/A
Test Data	If available and if inaccessible areas are indicated as needing abatement. Showing species and CFU or other growth density information.  N/A
Recommendations	More than one if indicated by professional analysis. Chief recommendation if multiple recommendations are indicated. Why (the basis) for one solution over others.  N/A
Part A Revised	Corrected, updated copy of Part A (Mold)  N/A

## Attachment 7

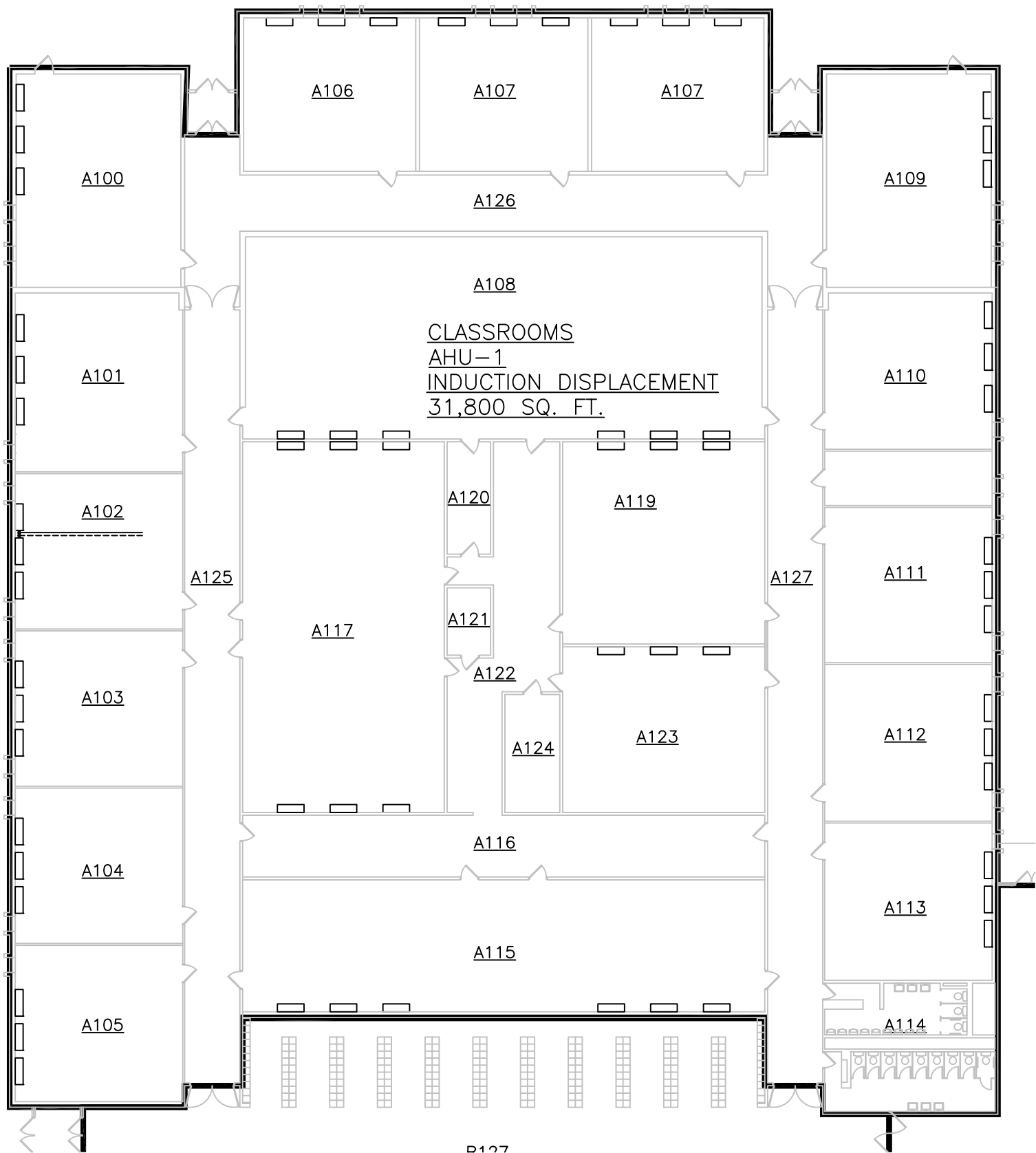
**Five Year Plan Information Submittal** -- The below form is required to be submitted to the MDE for each Health and Safety project that exceeds \$500,000 in cost that the district plans to fund under M.S. 123B.57 and M.S. 123B.59. One form is required for each Project. Activity extending out to five years must be shown.

Name or Identifying Information of Project	Forest Lake High School
Building	6101 Scandia Trl N Forest Lake, MN 55025
Project Description	<p>The project consists of demolition of the existing outdated air handling equipment and replacing the equipment with systems capable of providing the design ventilation rates. The replacement of the mechanical system components will require incidental architectural and structural element modifications that are required to complete the mechanical installations. The existing DDC control logic systems will be expanded to include the new mechanical equipment and systems.</p> <p>Included in this work is the replacement of the ventilation systems in classrooms, and media center. New air handling units that will provide tempered air via ductwork capable of providing the required ventilation rates and filtration. These new systems will provide the proper required ventilation for the occupants.</p> <p>The project will include installation of new supply and exhaust duct distribution to spaces that are not presently ventilated at appropriate levels. The exhaust systems will be brought to current code requirements. Spaces that contain cleaning chemical that are currently not properly ventilated will be fitted with exhaust and supply air.</p> <p>The existing building automation systems will be expanded to accept the new equipment and control functions required to properly ventilate the building.</p> <p>The project will include commissioning of the new mechanical installations and systems.</p> <p>There are no outside funding sources for these projects.</p>
Fiscal Years of Project	Summer construction from June, 2013 through September 2013.
Project Cost Per Year	2012-2013 fiscal year \$1,500,000 2013-2014 fiscal year \$1,500,000
Does Project Require Review and Comment?	Yes
Status of Engineering Study	Study was completed on July 19, 2012 and is being submitted to the Dept. of Education.
Bond, Levy or Both?	Bond
If Bonding, number, dates and amounts of each issue	

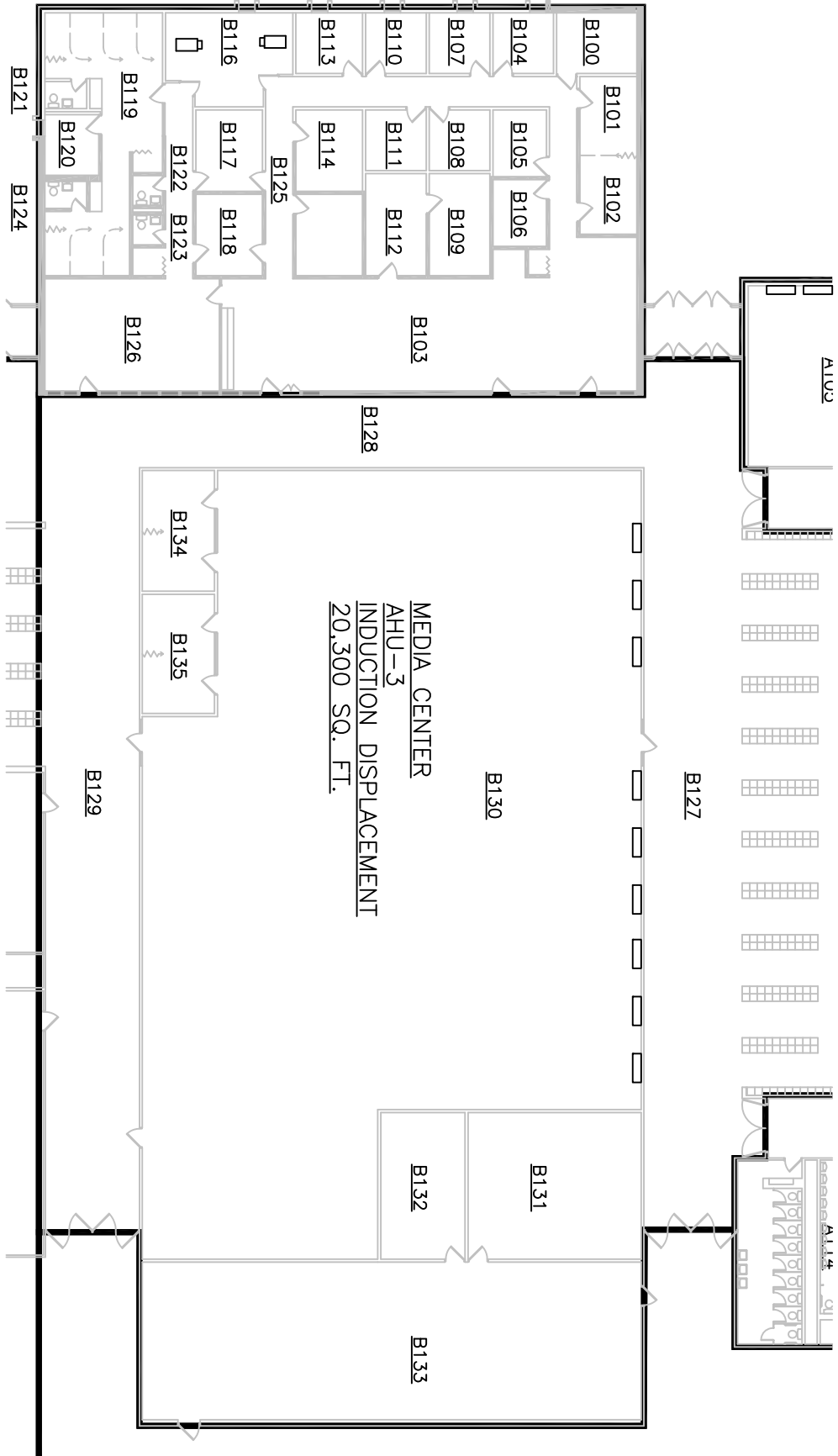
Attachment 7

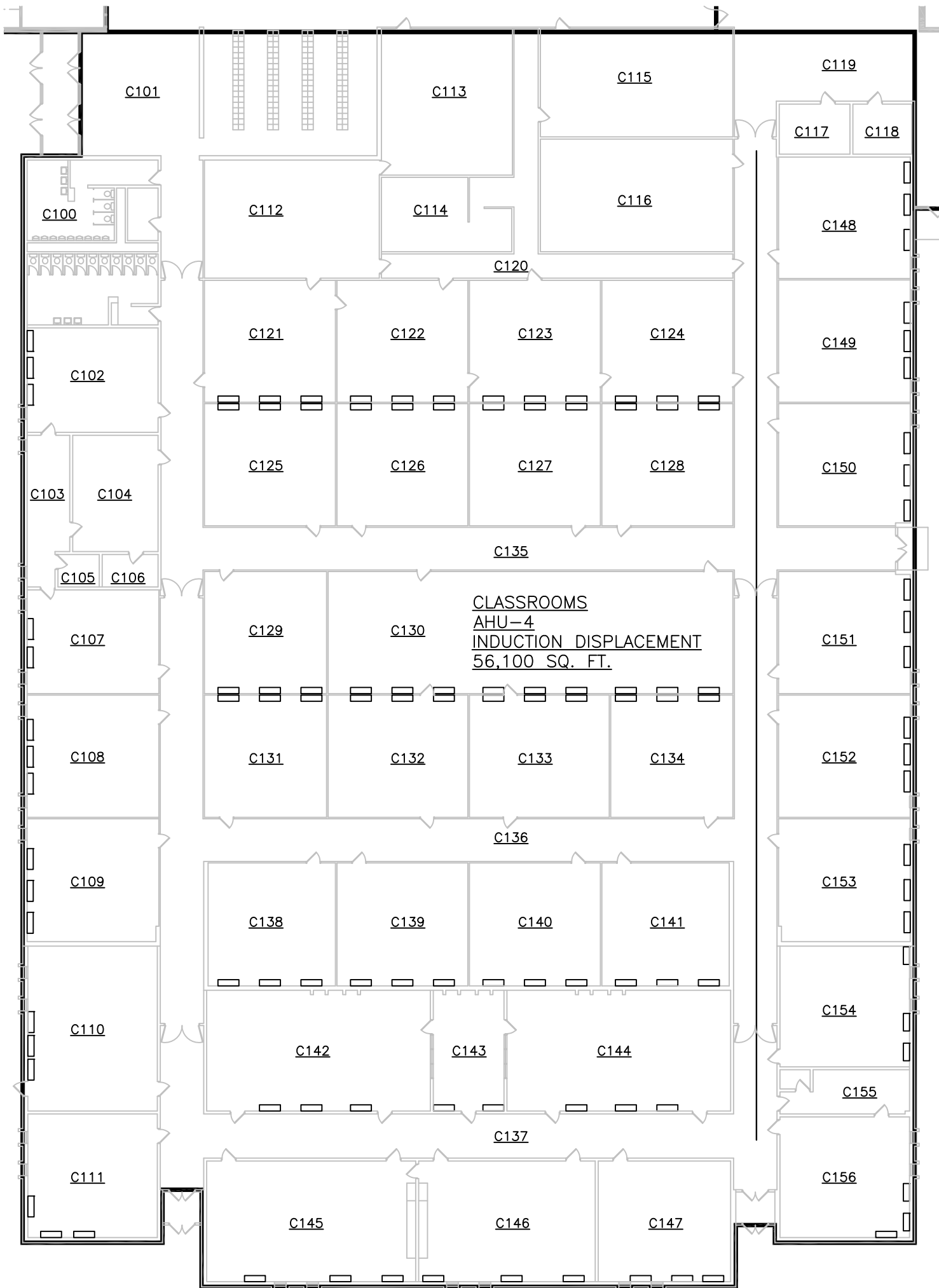
Names of Professionals	DLR Group





ADMINISTRATION  
AHU-2  
VAV  
6,400 SQ. FT.





## ATTACHMENT 8

### Steps to Follow for Health and Safety (H&S) Projects Exceeding \$500,000 Total Cost

The 2003 Legislature modified Minnesota Statutes section 123B.57 (H&S statute) and Minnesota Statutes section 123B.59 (Alternative Facilities statute), requiring that all projects (and related projects) with an aggregate cost of \$500,000 or greater be processed differently than H&S projects of lesser cost. These projects are subject to commissioner's consultation, and if the estimated cost is greater than \$1,400,000, to the review and comment process. The following are the steps necessary to gain approval for these projects.

1. **Load the project(s)** – Project must be loaded onto the H&S Website. Related projects must be determined and also loaded. Projects are related if the work is similar in kind or if the reason for doing one is linked to another, are approvable under criteria found in Minnesota Statutes section 123B.57, and are for the same building. They may be for separate years.

2. **Provide engineering study** – An engineering study per certain categories of allowable expense noted in Attachment 3 must be conducted by an architect or engineer (or CIH for mold) and reviewed by MD, before July 23, 2010, in order to be included on 2010 Pay 2011 levy. Lacking this, the agency may grant a provisional project approval (PPL for levy, or PPB for bond) to the project, pending review and approval of the final engineering study report, no later than November 5, 2010. The formats for the necessary reports and for mechanical ventilation and mold abatement projects are provided in *Attachment 7*. PPLs or PPBs may be granted if *Attachment 7A* only is received by July 23, 2010, and the agency believes the remaining documentation is forthcoming.

3. **IAQ Exclusion Checklist** – The district shall complete and return the IAQ Exclusion Checklist, found on pages 43 and 44.

4. **Publication of intended projects/proof of notification** – Minnesota Statutes section 123B.59, subdivisions 3 and 3a, describe this requirement. The language included below reflects amendments in Laws 2009, Chapter 96, Article 4, Sections 4 and 5, which eliminates publication of a required review and comment.

For projects funded by bonding, "at least 20 days before the earliest of solicitation of bids, the issuance of bonds, or final certification of levies... the district must publish notice of the intended projects, the amount of the bond issue, and the total amount of district indebtedness."

For projects funded with annual levy, "at least 20 days before the final district certification of levies... the district must publish notice of the intended projects, the amount of the bond issue, and the total amount of district indebtedness."

MDE does not require proof of either notification prior to either project or funding approval, but requests a copy of this notification be provided subsequent to its publication. MDE may withdraw the funding approval if a district fails to publish notice of the intended projects under this section. Where not prohibited by either section, the notifications may be combined.

5. **Approvals (OKL, OKB, PPA, NMI, No)** – An engineering study (*Attachment 7*), five-year plan (*Attachment 7*) and proof of notification, per Minnesota Statutes section 123B.59 shall all be received before an approval is granted (either "OKL" for levy or "OKB" for bonding, as determined by the district, which means the same as a "Yes"). A "PPL" or "PPB" approval designator can be assigned if the district plans to provide all required documentation no later than November 5, 2010. This will cause the projects to appear on the levy certified on September 30. Failure to provide the information in a suitable format will result in a reversal of this levy certification by November 30, and for projects to receive a "NMI" approval. It is important for districts to confirm that any submissions after September 24 intended to maintain levy certification beyond November 30 have accomplished this action. The November rescinded approval may yet be re instated by the district, until levy certification in December.

**6. Review and comment or consultation per Minnesota Statutes section 123B.71** – Following project review under Minnesota Statutes section 123B.57 and 123B.59, projects that exceed \$500,000 require commissioner's consultation and projects exceeding \$1,400,000 may require a review and comment per Minnesota Statutes section 123B.71 subsequent to approval under Minnesota Statutes section 123B.59. The district should set aside **60 days** from receipt of the review and comment submission at the MDE for the commissioner review process. Contact MDE's finance specialist John Bulger at 651-582-8781 or [John.Bulger@state.mn.us](mailto:John.Bulger@state.mn.us) for more information. [View Review and Comment Checklist, and the School District Consultation Checklist](#) ([http://education.state.mn.us/MDE/Accountability\\_Programs/Program\\_Finance/Facilities\\_Health\\_Safety/index.html](http://education.state.mn.us/MDE/Accountability_Programs/Program_Finance/Facilities_Health_Safety/index.html)) for procedure and submittal requirements.

**7. Letter from commissioner** – Following both project approval, commissioner's consultation/review and comment, the district will receive a letter of approval from MDE authorizing the district to proceed with both the project and funding. Every requirement under Minnesota Statutes section 123B.57, Minnesota Statutes section 123B.59 and Minnesota Statutes section 123B.71 must be met except the requirement for notification before the commissioner's letter will be generated and the district can proceed with the project and its funding. Again, MDE may withdraw the funding approval if a district fails to publish notice of the intended projects under this section.

**8. Fiscal year closeout** – FY 2010 Alternative Facilities Bonding and Levy project costs will appear in closeout documents processed by the MDE and districts during November and December of 2010. Districts are reminded that postings to Uniform Financial Accounting and Reporting Standards (UFARS) for these costs should have a Program Code designator of 855 rather than 850, and that the original range of Finance Codes (347, 349, etc.) should be retained, along with a district defined Course Code.

ISD Name / # \_\_\_\_\_ 831 \_\_\_\_\_ Date 7/19/2012 Completed By Larry Martini \_\_\_\_\_

TO: Districts interested in obtaining funding for mechanical ventilation projects under either Health and Safety or Alternative Facilities Bonding and Levy

A review of several mechanical ventilation projects requesting funding under the H&S and Alternative Facilities programs have resulted in the following list of **allowable – not allowable** expenditures. A district must evaluate the scope of work to make sure that **non-allowable** work elements are not contained in their job, or if they are, are funded by another source. Districts shall initial each “**non-allowable**” element below and return this to MDE as a condition of receiving final project approval before final approval is granted (PPA, PPL or PPB, and OKL or OKB). By initialing, the district acknowledges these categories of work are not included in the above projects. Please note that, as a result of possible downward financial adjustments, the eligible approvable amount may be less than \$500,000 causing the project to be ineligible for Alternate Facilities treatment. Any corrected amounts must be posted to the H&S Website by the district. Also, please note that related projects must be grouped by building only and not by district.

**\_LM Allowable and not allowable – drop ceilings.** Replacement or restoration of ceilings in support of the operation of an HVAC system is an allowable H&S expenditure. In order to qualify it must support some HVAC function, such as return air or sound deadening. Covering exposed duct or other aesthetics purpose is not an allowable reason.

**\_LM Not allowable – Lighting.** Replacement or restoration of any lighting subsequent to funded HVAC is not an allowable H&S expenditure.

**\_LM Allowable – Pipes.** Heating or cooling pipes or piping leading to or from, or otherwise associated with the mechanical ventilation system is an allowable H&S expenditure.

**\_LM Allowable and not allowable – Cooling capacity as part of dehumidification.** Cooling capacity, cooling coils, cooling compressors, control logic leading to a system that is dedicated to operating in a pure cooling mode without consideration for effect on humidity, is not an allowable H&S expenditure. Funding for a cooling then re-heat system is permitted, if dehumidification engineering and operation meets the following criteria.

*Discussion: Mold growth can occur as indicated in reference (1)\* Appendix C due to either vapor pressure-dominated mold or surface temperature-dominated mold (pp144-145). The test for control of vapor pressure-dominated mold management is whether the conditioned air entering each space from a dehumidification system is no greater than seventy-five (75%) RH (relative humidity), verified by continual measurement of each space's air serviced by the mechanical ventilation system. The test for surface temperature dominated mold management is whether localized variances in temperature brought about by a cooling source cause any interior surface to achieve a relative humidity above sixty percent (60%).*

*Action: Humidity sensors shall be placed in each space serviced by the mechanical ventilation system and connected to its system control logic, set so that each space's relative humidity does not exceed fifty five percent (55%) RH. If a dehumidification system is a simple cooling-then-reheat system and if the cooling function is active, then temperature in the reheat portion shall be increased until the RH in each space does not exceed 55%. This will satisfy vapor pressure-dominated mold management concerns. The system shall be designed so that the RH does not exceed sixty percent (60%) RH at or near the coolest surface. This will satisfy surface temperature-dominated mold management concerns.*

The services of a professional engineer (PE) experienced in mold management techniques will be utilized in the design, installation and certification of the dehumidification system to ensure that both vapor pressure-dominated criteria and surface temperature-dominated are met. Performance criteria to this effect will be documented and shall be part of the commissioning process (H&S funding-eligible for new or upgraded systems only). The system shall be capable of being operated and shall be operated observing these relative humidity requirements throughout its annual operational cycle. Temperature adjustment to maintain proper RH shall take priority over temperature adjustment for comfort control. It

shall not be possible for vendors or users to disable this except for maintenance. Also, airstream surfaces downstream from a dehumidification coil shall not have exposed fibrous insulation material.

**\_LM\_ Allowable.** Upgrade or replacement to meet current AHSRAE and state mechanical code ventilation rate (15 CFM per person).

**\_LM\_ Not allowable.** Repairs to existing systems, regardless of whether they already have the capability of meeting current state mechanical code ventilation rate (15 CFM per person).

**\_LM\_ Not allowable – Heating capacity.** Heating capacity such as internal gas-fired heating units, internal or external boilers, water storage and distribution systems, is not an allowable H&S expenditure.

**\_LM\_ Not allowable – Energy recovery system.** An energy recovery system whose function is or includes transferring energy from one portion of the system to another in order to reduce energy usage or costs, is not an allowable H&S expenditure.

**Allowable – Roof reinforcement.** Only costs that lead to direct physical structural support of roofs due to increased weight loading brought about by installation of mechanical ventilation units are allowable. Costs to enhance or restore roof or understructure in areas not immediately adjacent to any weight caused by mechanical ventilation installation or replacement is not an allowable H&S expenditure.

**Allowable – Wall.** Wall construction within an existing structure to create a space dedicated for mechanical ventilation equipment where none existed before is an allowable H&S expenditure. Also allowable is a roof structure for containing roof-mounted units, together with safe access ways from the building to the structure. The cost for fixtures such as cabinetry, shelving and the like is not allowable. Only the basic cost for formation of the space is allowable.

**Allowable – Asbestos abatement.** Asbestos abatement or any other work allowable under current H&S criteria is allowable as a related expenditure under the Alternative Facilities program, but only for work in the area immediately adjacent to work (within three feet), which is originally intended to be covered under the Alternative Facilities program. If the work is otherwise eligible under H&S, it can be funded but not as a related expenditure.

**Allowable.** Additional square footage in lieu of roof construction for mechanical ventilation systems that result in reduced costs.

\*(1) EPA-NIOSH Building Air Quality – Appendix C

Contact MDE (Michael Oxborough) at 651-582-8509 or [michael.oxborough@state.mn.us](mailto:michael.oxborough@state.mn.us).



HVAC ♦ MECHANICAL ♦ ELECTRICAL  
REFRIGERATION ♦ 24/7 SERVICE

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FAX: 651-310-0403

[www.nwsme.com](http://www.nwsme.com)

110 Sycamore Street West  
Saint Paul, MN 55117-5451

# Test and Balance Reports

## Forest Lake High School

03/05/12-03/09/12

NWS Job # R 4539

[www.nwsme.com](http://www.nwsme.com)

110 Sycamore Street West  
Saint Paul, MN 55117-5451

Phone: 651-310-0102 Fax: 651-310-0403



# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 1 OF 60

SYSTEM: ACU-1 Multi  
LOCATION: Penthouse Stage Area

SERVING: A-Wing and Lounge

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Painted/No Tag's	INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	12/24"x24"x15" Bag	FAN SHEAVE:	12-1/2" x 2-5/8"
	4/12"x24"x15" Bag	MOTOR SHEAVE:	12" x 1-7/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	53-1/2"
MANUFACTURER:	Marathon New	BELT SIZE/QUANTITY:	CX136" x 2
FRAME:	286T		
HORSEPOWER:	30 HP		
SERVICE FACTOR:			
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	33,310
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	24,769 74%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1773	RPM	
VOLTAGE/PHASE:	230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	73/36.5	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 2 OF 60

SYSTEM: ACU-1                      SERVING 100 Wing

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	83" x 96"	55.33				602	33,310		Velgrid

**COMMENTS:** Readings at filter bank.

## SYSTEM DEFICIENCIES REPORT

**PROJECT:** Forest Lake HS  
**SUBMITTED TO:**  
**REPORT NO:** R 4539  
**REPORT DATE:** 03/05/12-03/09/12

PAGE: 3 OF 60

[illegible]

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 4 OF 60

SYSTEM: ACU-2 Multi SERVING: Main Office  
LOCATION: Main Office

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Painted/No Tag's	INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	3/12"x12"x15" Bag	FAN SHEAVE:	6-3/4" x 1-7/16"
	3/20"x24"x15" Bag	MOTOR SHEAVE:	4-3/4" x 1-1/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	27-1/2"
MANUFACTURER:	Pacer	BELT SIZE/QUANTITY:	BX70" x 2"
FRAME:	184T		
HORSEPOWER:	5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	6632
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	4774 71.9%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1735	RPM	
VOLTAGE/PHASE:	230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	14.2/7.1 3-phase	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 5 OF 60

SYSTEM: ACU-2

SERVING Nursing, Office

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	48" x 24"	8				829	6632		Pitot

**COMMENTS:**

**PROJECT:** Forest Lake HS  
**SUBMITTED TO:**  
**REPORT NO:** R 4539  
**REPORT DATE:** 03/05/12-03/09/12 **PAGE:** 6 OF 60

[illegible]



# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 7 OF 60

SYSTEM: ACU-3 Multi SERVING: Media  
LOCATION: Penthouse/Stage

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Painted/No Tag's	INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	4/20"x24"x15"	FAN SHEAVE:	19" x 2-3/16"
	8/24"x24"x15" Bag	MOTOR SHEAVE:	5-1/2" x 1-3/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	36-1/8"
MANUFACTURER:	Painted	BELT SIZE/QUANTITY:	52 BX108 x 2"
FRAME:	213T		
HORSEPOWER:	7.5 HP		
SERVICE FACTOR:			
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	13,010
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	10,655 82%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1740	RPM	
VOLTAGE/PHASE:	230/463 3-phase	VOLTS	
AMPERAGE/PHASE:	20.6 10.3	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 8 OF 60

SYSTEM: ACU-3 SERVING Library, Media Center

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	68" x 96"	45.33				287	13,010		Velgrid

**COMMENTS:** Readings at filter bank.



[illegible]

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

PAGE 10 OF 60

SYSTEM: ACU-4 Multi

SERVING: North C

LOCATION: Penthouse/Stage

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Painted/No Tag's	INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	12/24"x24"x15"	FAN SHEAVE:	16" x 2-3/4"
	4/12"x24"x15" Bag	MOTOR SHEAVE:	11" x 2-1/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	55-1/2"
MANUFACTURER:	Marathon New	BELT SIZE/QUANTITY:	CX144" x 2"
FRAME:	324T		
HORSEPOWER:	40 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	42,551
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	17,521 41%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1780	RPM	
VOLTAGE/PHASE:	208 230 460	VOLTS	
AMPERAGE/PHASE:	104 96 48	AMPS	
BRAKE		BHP	
HORSEPOWER:			
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 11 OF 60

SYSTEM: ACU-4 SERVING North 300 Wing

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	83" x 96"	55.33				769	42,551		Velgrid

**COMMENTS:** Readings at filter bank.

# SYSTEM DEFICIENCIES REPORT

PROJECT: Forest Lake HS  
SUBMITTED TO:  
REPORT NO: R 4539  
REPORT DATE: 03/05/12-03/09/12

PAGE: 12 OF 60

SYSTEM #	ITEM #	CORRECTED ( )	
ACU-4			Steam line dripping on top of unit-on to conduit with motor feeds.
ACU-4			Outside air damper does not appear to fully close at unit shut down.

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

PAGE 13 OF 60

SYSTEM: ACU-5 Multi

SERVING: South C

LOCATION: Penthouse/Stage

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Painted/No Tag's	INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	12/24"x24"x15"	FAN SHEAVE:	16" x 2-11/16"
	4/12"x24"x15" Bag	MOTOR SHEAVE:	10" x 2-1/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	60-3/4"
MANUFACTURER:	Marathon New	BELT SIZE/QUANTITY:	52 CX158" x 2"
FRAME:	324T		
HORSEPOWER:	40 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	41,942
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	29,296 70%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1780	RPM	
VOLTAGE/PHASE:	208 230/460	VOLTS	
AMPERAGE/PHASE:	104 96 48	AMPS	
BRAKE		BHP	
HORSEPOWER:			
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 14 OF 60

SYSTEM: ACU-5 SERVING South 300 Wing

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	83" x 96"	55.33				758	41,942		Velgrid
COMMENTS: Readings at filter bank.									



# FAN EQUIPMENT

JOB NAME: Forest Lake High School  
 LOCATION: \_\_\_\_\_  
 NWS PROJECT #: R 4539  
 TECHNICIAN: Tom Cederberg

DATE: \_\_\_\_\_  
 DRAWING NO: \_\_\_\_\_  
 DRAWING DATE: \_\_\_\_\_  
 PAGE 15 OF 60

SYSTEM: ACU-6 Multi SERVING: Auditorium  
 LOCATION: Penthouse/Stage

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Painted/No Tag's	INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	12/24"x24"x15"	FAN SHEAVE:	30-1/2" x 2-1/2"
	4/12"x24"x15" Bag	MOTOR SHEAVE:	6-3/4" x 1-3/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	52-1/2"
MANUFACTURER:	Marathon New	BELT SIZE/QUANTITY:	BX162" x 2"
FRAME:	254T		
HORSEPOWER:	15 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	29,878
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	5617 19%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1470	RPM	
VOLTAGE/PHASE:	208 230/460	VOLTS	
AMPERAGE/PHASE:	40.6 37 18.5	AMPS	
BRAKE		BHP	
HORSEPOWER:			
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 16 OF 60

SYSTEM: ACU-6 SERVING Auditorium

[illegible]



**PROJECT:** Forest Lake HS  
**SUBMITTED TO:**  
**REPORT NO:** R 4539  
**REPORT DATE:** 03/05/12-03/09/12 **PAGE:** 17 OF 60

[illegible]

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: ACU-7 Multi

SERVING: 507,507-Office,511,519,512,  
548, 544,542,540

LOCATION: Mechanical Room By Café

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Painted/No Tag's	INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	2/25"x120"	FAN SHEAVE:	7" x 2-5/8"
		MOTOR SHEAVE:	8-1/4" x 1-5/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	42-1/2"
MANUFACTURER:	Marathon	BELT SIZE/QUANTITY:	BX103" x 3
FRAME:	254T		
HORSEPOWER:	15 HP		
SERVICE FACTOR:			
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL	
SYSTEM TOTAL CFM:		CFM	13,811	
RETURN AIR CFM:		CFM		
OUTDOOR AIR CFM:		CFM	7029	51%
OUTLET TOTAL CFM:		CFM		
T.F.S.P.:		IN/WATER		
FAN RPM:		RPM		
MOTOR RPM:	1775	RPM		
VOLTAGE/PHASE:	208 230/460	VOLTS		
AMPERAGE/PHASE:	40.6 37 18-1/2	AMPS		
BRAKE HORSEPOWER:		BHP		
CFM BY:				
DUCT TRAVERSE:				
FLOWHOOD:				
TSI HOT WIRE:				
ROTATING VANE:				
ADM 870				

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 19 OF 60

SYSTEM: ACU-7                      SERVING Arts

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
1 Supply	32" diam.	5.58				1092	6093		Pilot
2 Supply	30" diam.	4.90				1575	7718		Pilot
Total							13,811		

**COMMENTS:**

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: ACU-8 Multi

SERVING: Music

LOCATION: Mechanical Room By Café

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Units Painted	INLET PRESSURE:	
MODEL NO:	No Tag Found	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	2/25"x100" 1 pc.	FAN SHEAVE:	10-3/4" x 1-5/8"
		MOTOR SHEAVE:	5-1/2" x 1-1/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	41-1/2"
MANUFACTURER:	GE	BELT SIZE/QUANTITY:	AX105 x 2
FRAME:	184T		
HORSEPOWER:	5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	6953
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	3989 57%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1740	RPM	
VOLTAGE/PHASE:	230/460	VOLTS	
AMPERAGE/PHASE:	12.6 6.3	AMPS	
BRAKE		BHP	
HORSEPOWER:			
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 21 OF 60

SYSTEM: ACU-8

SERVING Music

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
1 Supply	16" x 16"	1.78				912	1621		
2 Supply	14" x 14"	1.36				409	557		
3 Supply	16" x 16"	1.78				229	408		
4 Supply	18" x 15"	1.88				1079	2028		
5 Supply	20" x 20"	2.78				842	2339		
Total							6953		

**COMMENTS:**



# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: AHU-1

SERVING: Field House

LOCATION: Field House Penthouse

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	CAH035FHAC	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	FBOU990900344	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	3 / 1 pc. 20"x100"	FAN SHEAVE:	12-3/4" x 2-3/16"
		MOTOR SHEAVE:	5-1/8" x 1-5/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	10-1/2"
MANUFACTURER:	Lincoln	BELT SIZE/QUANTITY:	BX46" x 2
FRAME:	254T		
HORSEPOWER:	15 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	13,614
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	45
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:		RPM	
VOLTAGE/PHASE:	230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	40 20	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME: Forest Lake High School  
LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 23 OF 60

SYSTEM: AHU-1 SERVING Gym / Field House

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	86" x 41"	24.49				556	13,614		Velgrid

**COMMENTS:** Readings across coil/by-pass closed.

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: AHU-2 Field House

SERVING: Field House

LOCATION: Field House Mechanical Rm

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	CAH035FHAC	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	FBOU990900338	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	3 / 1 pc. 20"x100"	FAN SHEAVE:	12-3/4" x 2-3/16"
		MOTOR SHEAVE:	5-1/8" x 1-5/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	10-1/2"
MANUFACTURER:	Baldor	BELT SIZE/QUANTITY:	BX46" x 2
FRAME:	254T		
HORSEPOWER:	15 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	13,592
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	6461 48%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1760	RPM	
VOLTAGE/PHASE:	230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	40.6/20.3 3-phase	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			



# SUMMARY OF TRAVERSE READINGS

JOB NAME: Forest Lake High School  
 LOCATION: \_\_\_\_\_  
 NWS PROJECT #: R 4539  
 TECHNICIAN: Tom Cederberg

DATE: 03/05/12-03/09/12  
 DRAWING NO: \_\_\_\_\_  
 DRAWING DATE: \_\_\_\_\_  
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SYSTEM: AHU-2 SERVING Gym / Field House

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	86" x 41"	24.49				5565	13,592		Velgrid

**COMMENTS:** Readings across coil/by-pass closed.

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/0912

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: AHU-3

SERVING: Lobby

LOCATION: Mezzanine

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	CAH035FDAC	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	FBOU990900339	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:		FAN SHEAVE:	11-3/4" x 1-3/16"
		MOTOR SHEAVE:	7-1/4" x 1-3/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	11-5/8"
MANUFACTURER:	Magnetic	BELT SIZE/QUANTITY:	BX48" x 1
FRAME:	5213T		
HORSEPOWER:	7.5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	7859
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	1101
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1760	RPM	
VOLTAGE/PHASE:	208 230/460	VOLTS	
AMPERAGE/PHASE:	19.8 19.2 9.6	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
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SYSTEM: AHU-3 SERVING Lobby

[illegible]

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: AHU-4

SERVING: Wrestling Room

LOCATION: Field House Custodial Closet

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	CAH0CIFDAC	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	FBOU990900340	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	1 / 24"x84"	FAN SHEAVE:	11-7/8" x 1-7/16"
	1 / 20"x84"	MOTOR SHEAVE:	6" x 1-3/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	11-1/4"
MANUFACTURER:	Baldor	BELT SIZE/QUANTITY:	BX46" x 2
FRAME:	215T		
HORSEPOWER:	10 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	8458
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	364 4%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:		RPM	
VOLTAGE/PHASE:	208 230/460	VOLTS	
AMPERAGE/PHASE:	28.2 28/14	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

# SUMMARY OF TRAVERSE READINGS

JOB NAME: Forest Lake High School  
 LOCATION: \_\_\_\_\_  
 NWS PROJECT #: R 4539  
 TECHNICIAN: Tom Cederberg

DATE: 03/05/12-03/09/12  
 DRAWING NO: \_\_\_\_\_  
 DRAWING DATE: \_\_\_\_\_  
 PAGE 29 OF 60

SYSTEM: AHU-4 SERVING C Wing

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	64-1/2" x 40"	17.92				472	8458		Velgrid

**COMMENTS:** Readings at filter bank.



# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: AHU-5

SERVING: G Wing

LOCATION: Mezzanine

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	CAH012FMAC	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	FBOU990900341	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	1 / 1 pc. 12"x64"	FAN SHEAVE:	11-3/4" x 1-3/16"
	1 / 1 pc. 24"x64"	MOTOR SHEAVE:	7" x 1-3/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	10-3/4"
MANUFACTURER:	Magnetic	BELT SIZE/QUANTITY:	BX48" x 1
FRAME:	5213T		
HORSEPOWER:	7.5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	5011
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	3290 66%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1760	RPM	
VOLTAGE/PHASE:	208 230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	19.8 19.2/9.6	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 31 OF 60

SYSTEM: AHU-5 SERVING G Wing

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
O.A.	46" x 26"	8.31				396	3,290		66% Pilot
Supply	46" x 26"	8.31				603	5011		Pilot
<b>COMMENTS:</b>									

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION:

NWS PROJECT #: R 4539

TECHNICIAN: Tom Cederberg

DRAWING NO:

DRAWING DATE:

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SYSTEM: AHU-6

SERVING: Auto Shop Classroom

LOCATION: Auto Shop Class Room Hanging

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	CAH003FDAC	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	FBOU990900343	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	1 / 20"x34"	FAN SHEAVE:	9-3/4" x 1-1/8"
		MOTOR SHEAVE:	5-3/8" x 1-1/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	9-1/2"
MANUFACTURER:	Magnetic	BELT SIZE/QUANTITY:	BX40 x 1
FRAME:	5184T		
HORSEPOWER:	5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	1160
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	171 14.8%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1745	RPM	
VOLTAGE/PHASE:	208 230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	14.8 14 7	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			



## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 33 OF 60

SYSTEM: AHU-6 SERVING Auto Shop Classroom

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	5 Outlets						1160		

**COMMENTS:** Hood Readings

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 34 OF 60

SYSTEM: AHU-7 SERVING: Shop Area  
LOCATION: Auto Shop

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	CAH014FHAC	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	FBOU490900342	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	1 / 1 pc. 12"x72"	FAN SHEAVE:	4-3/4" x 7/8"
	1 / 1 pc. 24"x72"	MOTOR SHEAVE:	3-1/2" x 1"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	10-1/4"
MANUFACTURER:	Baldor	BELT SIZE/QUANTITY:	BX40 x 1
FRAME:	182T		
HORSEPOWER:	3 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL	
SYSTEM TOTAL CFM:		CFM	7474	
RETURN AIR CFM:		CFM		
OUTDOOR AIR CFM:		CFM	4274	57%
OUTLET TOTAL CFM:		CFM		
T.F.S.P.:		IN/WATER		
FAN RPM:		RPM		
MOTOR RPM:	1725	RPM		
VOLTAGE/PHASE:	208 230/460 3-phase	VOLTS		
AMPERAGE/PHASE:	8.7 8/4	AMPS		
BRAKE HORSEPOWER:		BHP		
CFM BY:				
DUCT TRAVERSE:				
FLOWHOOD:				
TSI HOT WIRE:				
ROTATING VANE:				
ADM 870				

# SUMMARY OF TRAVERSE READINGS

JOB NAME: Forest Lake High School  
 LOCATION: \_\_\_\_\_  
 NWS PROJECT #: R 4539  
 TECHNICIAN: Tom Cederberg

DATE: 03/05/12-03/09/12  
 DRAWING NO: \_\_\_\_\_  
 DRAWING DATE: \_\_\_\_\_  
 PAGE 35 OF 60

SYSTEM: AHU-7 SERVING Shop Area

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
1 Supply	22" diam.	2.64				1112	2936		Pilot
2 Supply	22" diam.	2.64				1271	3355		Pilot
3 Supply	22" diam.	2.64				448	1183		Pilot
Total							7474		

**COMMENTS:**

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

PAGE 36 OF 60

SYSTEM: RTU-1

SERVING: 111,113,115,117,119, A-Wing Independents

LOCATION: Roof

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Trane	INLET PRESSURE:	
MODEL NO:	SXHCC2540J1063CD3A01AGI	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	J89F71672	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	3 / 1 pc. 20"x90"	FAN SHEAVE:	9-3/4" x 1-7/16"
		MOTOR SHEAVE:	6-3/4" x 1-3/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	21-1/8"
MANUFACTURER:	Magnetic e-Plus	BELT SIZE/QUANTITY:	BX-65 x 1
FRAME:	5213T		
HORSEPOWER:	7.5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	3915
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	602 15%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1750	RPM	
VOLTAGE/PHASE:	230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	18.3/9.15	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 37 OF 60

SYSTEM: RTU-1 SERVING 111,113,115

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
O.A.	35" x 34"	8.26				73	602		15% Velgrid
1 Supply	48" x 14"	4.67				581	2713		Pilot
2 Supply	28" x 12"	2.33				516	1202		Pilot
Total							3915		

**COMMENTS:**



# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 38 OF 60

SYSTEM: RTU-2 SERVING: Girls Locker/Storage  
LOCATION: Roof

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	Titon Air Inc.	INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	6 / 1 pc. 20"x40"	FAN SHEAVE:	5-1/2" x 1-11/16"
		MOTOR SHEAVE:	4-3/4" x 1-1/16"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	19-1/2"
MANUFACTURER:	Dayton	BELT SIZE/QUANTITY:	BX52 x 2
FRAME:	184T		
HORSEPOWER:	5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	3237
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	1682 52%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:		RPM	
VOLTAGE/PHASE:	208 230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	14.5 13.1/6.6	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

# SUMMARY OF TRAVERSE READINGS

JOB NAME: Forest Lake High School  
 LOCATION: \_\_\_\_\_  
 NWS PROJECT #: R 4539  
 TECHNICIAN: Tom Cederberg

DATE: 03/05/12-03/09/12  
 DRAWING NO: \_\_\_\_\_  
 DRAWING DATE: \_\_\_\_\_  
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SYSTEM: RTU-2 SERVING 111,113,115

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
1 Supply	42" x 12"	3.5				546	1911		
2	36" x 12"	3				442	1326		
Total							3237		

**COMMENTS:**

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 40 OF 60

SYSTEM: RTU-3  
LOCATION: Roof

SERVING: Kitchen

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	RPS015CSY	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	FBOU0705009489	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:		FAN SHEAVE:	8" x 1-15/16"
		MOTOR SHEAVE:	8-1/2" x 1-3/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	12-3/8"
MANUFACTURER:	Baldor	BELT SIZE/QUANTITY:	B-47
FRAME:	213T		
HORSEPOWER:	7.5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL	
SYSTEM TOTAL CFM:		CFM	2385	
RETURN AIR CFM:		CFM		
OUTDOOR AIR CFM:		CFM	1341	56%
OUTLET TOTAL CFM:		CFM		
T.F.S.P.:		IN/WATER		
FAN RPM:		RPM		
MOTOR RPM:	1770	RPM		
VOLTAGE/PHASE:	230/460 3-phase	VOLTS		
AMPERAGE/PHASE:	19.2/9.6	AMPS		
BRAKE		BHP		
HORSEPOWER:				
CFM BY:				
DUCT TRAVERSE:				
FLOWHOOD:				
TSI HOT WIRE:				
ROTATING VANE:				
ADM 870				



## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
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SYSTEM: RTU-3 SERVING Kitchen

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
1 O.A.	28" x 31.5"	6.1				65	396		56% Velgrid
2 O.A	28" x 31.5"	6.1				155	945		
Total							1341		
Supply	13 Outlets						2385		

**COMMENTS:** Unit at 24 HTZ

**Supply Hood Readings**

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: HU-1

SERVING: Metal Shop

LOCATION: Metal Shop

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	6.0.845077-090	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	HA-214 H	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	78"x25"x2" 1 pc.	FAN SHEAVE:	8-1/2" x 1-7/16"
		MOTOR SHEAVE:	4-3/4" x 7/8" ADJ
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	20-3/8"
MANUFACTURER:	Lincoln	BELT SIZE/QUANTITY:	A-58 x 1
FRAME:	145T		
HORSEPOWER:	2 HP 3-phase		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	5506
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	593 11%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1750	RPM	
VOLTAGE/PHASE:	230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	6.0 3.0	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 43 OF 60

SYSTEM: HU-1 SERVING Metal Shop

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
O.A.	30" x 30"	6.25				95	593		11% Pilot
Return	68" x 18"	8.5				578	4913		Velgrid
Total							5506		

**COMMENTS:**

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION:

NWS PROJECT #: R 4539

TECHNICIAN: Tom Cederberg

DRAWING NO:

DRAWING DATE:

PAGE 44 OF 60

SYSTEM: HU-2

SERVING: Wood Shop

LOCATION: Wood Shop

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	6.0.845077-100	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	HA-209H	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	83"x16" / 1 pc. x 2	FAN SHEAVE:	7-3/4" x 1-7/8"
		MOTOR SHEAVE:	4-3/4" x 7/8" ADJ
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	15-7/8"
MANUFACTURER:	Century New	BELT SIZE/QUANTITY:	1-4L500H
FRAME:	145T		
HORSEPOWER:	2 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	2625
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	1000 38%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1750	RPM	
VOLTAGE/PHASE:	230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	5.8 2.9 3-phase	AMPS	
BRAKE		BHP	
HORSEPOWER:			
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
O.A.	26" x 26"	4.69				184	863		34% Pilot
Return	74" x 11-1/2"	5.91				275	1625		Velgrid
Total							2488		

**COMMENTS:**



# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
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SYSTEM: HU-3 SERVING: Power Shop/Small Engines  
LOCATION: Power Shop/Small Engines

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	HA 214 H	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:	6.0.845077-110	<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	78"x25" 1 pc. x 2	FAN SHEAVE:	9-3/4" x 1-7/16"
		MOTOR SHEAVE:	5-3/8" x 1-1/8" ADJ
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	20-9/16"
MANUFACTURER:	Marathon	BELT SIZE/QUANTITY:	AX-60 x 1
FRAME:	182T		
HORSEPOWER:	3 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL	
SYSTEM TOTAL CFM:		CFM	6375	
RETURN AIR CFM:		CFM		
OUTDOOR AIR CFM:		CFM	1094	17%
OUTLET TOTAL CFM:		CFM		
T.F.S.P.:		IN/WATER		
FAN RPM:		RPM		
MOTOR RPM:	1750	RPM		
VOLTAGE/PHASE:	230/460	VOLTS		
AMPERAGE/PHASE:	8.4 4.2	AMPS		
BRAKE HORSEPOWER:		BHP		
CFM BY:				
DUCT TRAVERSE:				
FLOWHOOD:				
TSI HOT WIRE:				
ROTATING VANE:				
ADM 870				

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 47 OF 60

SYSTEM: HU-3 SERVING Small Engines

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
O.A.	30" x 30"	6.25				175	1094		17% Pilot
Return	69" x 18"	8.63				612	5281		Velgrid
Total							6375		

**COMMENTS:**

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: HU-4

SERVING: Cafe

LOCATION: Above Light Booth

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	No Tags Found	INLET PRESSURE:	
MODEL NO:	Painted	DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	16 / 20"x20"x15"	FAN SHEAVE:	16-1/2" x 2-1/2"
		MOTOR SHEAVE:	6-1/2" x 1-1/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	48"
MANUFACTURER:	Lincoln	BELT SIZE/QUANTITY:	3X128 x 1
FRAME:	184T		
HORSEPOWER:	5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	15,854
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	5955 38%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1745	RPM	
VOLTAGE/PHASE:	230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	13.6 6.8	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			



# SUMMARY OF TRAVERSE READINGS

JOB NAME: Forest Lake High School  
 LOCATION: \_\_\_\_\_  
 NWS PROJECT #: R 4539  
 TECHNICIAN: Tom Cederberg

DATE: 03/05/12-03/09/12  
 DRAWING NO: \_\_\_\_\_  
 DRAWING DATE: \_\_\_\_\_  
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SYSTEM: HU-4 SERVING Cafeteria

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	81" x 81"	45.56				348	15,854		Velgrid

**COMMENTS:** Reading at filter bank.

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: HU-5

SERVING: South Gym

LOCATION: South Mezzanine/Gym

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:		INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	4 / 20"x20"x15"	FAN SHEAVE:	20-1/2" x 2-11/16"
	13 / 20"x24"x15", 3 / 24"x24x15"	MOTOR SHEAVE:	9" x 1-5/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	50-5/8"
MANUFACTURER:	General Electric	BELT SIZE/QUANTITY:	BX144 x 2
FRAME:	256T		
HORSEPOWER:	20 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	38,465
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	4102 11%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1750	RPM	
VOLTAGE/PHASE:	230/460	VOLTS	
AMPERAGE/PHASE:	51.4 25.7	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

# SUMMARY OF TRAVERSE READINGS

JOB NAME: Forest Lake High School  
 LOCATION: \_\_\_\_\_  
 NWS PROJECT #: R 4539  
 TECHNICIAN: Tom Cederberg

DATE: 03/05/12-03/09/12  
 DRAWING NO: \_\_\_\_\_  
 DRAWING DATE: \_\_\_\_\_  
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SYSTEM: HU-5 SERVING Main Gym

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
1 Supply	55" x 35"	13.37				1482	19,814		Pilot
2 Supply	55" x 35"	13.37				1395	18,651		Pilot
Total							38,465		

**COMMENTS:**

**PROJECT:** Forest Lake HS  
**SUBMITTED TO:**  
**REPORT NO:** R 4539  
**REPORT DATE:** 03/05/12-03/09/12 **PAGE:** 52 OF 60

[illegible]

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: HU-6

SERVING: North Gym

LOCATION: North Mezz/Gym

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:		INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	4 / 20"x20"x15"	FAN SHEAVE:	20-1/2" x 2-11/16"
	15 / 20"x24"x15", 3 / 24"x24"x15" Bag	MOTOR SHEAVE:	9" x 1-5/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	50-1/2"
MANUFACTURER:	Lincoln	BELT SIZE/QUANTITY:	BX144 x 2
FRAME:	256T		
HORSEPOWER:	20 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	39,462
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	1026 3%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1750	RPM	
VOLTAGE/PHASE:	230/460	VOLTS	
AMPERAGE/PHASE:	50 25	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

# SUMMARY OF TRAVERSE READINGS

JOB NAME: Forest Lake High School  
 LOCATION: \_\_\_\_\_  
 NWS PROJECT #: R 4539  
 TECHNICIAN: Tom Cederberg

DATE: 03/05/12-03/09/12  
 DRAWING NO: \_\_\_\_\_  
 DRAWING DATE: \_\_\_\_\_  
 PAGE 54 OF 60

SYSTEM: HU-6 SERVING Gym North

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
Supply	107" x 92"	68.36				575	39,462		Velgrid

**COMMENTS:** Reading at filter bank.



# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 55 OF 60

SYSTEM: HU-7 SERVING: Health  
LOCATION: South Mezz/Gym

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:		INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	2 / 16"x84" 1 pc.	FAN SHEAVE:	6-7/8" x 1-7/16"
	3 / 20"x24"x15",	MOTOR SHEAVE:	4-1/8" x 7/8" solid
	3 / 24"x24"x15"		
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	18"
MANUFACTURER:	Dayton	BELT SIZE/QUANTITY:	A-50 x 1
FRAME:	145T		
HORSEPOWER:	1.5 HP		
SERVICE FACTOR:	1.15		
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	2147
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	875 41%
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1730	RPM	
VOLTAGE/PHASE:	208 230/460	VOLTS	
AMPERAGE/PHASE:	4.5 4.1/2.0	AMPS	
BRAKE		BHP	
HORSEPOWER:			
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

# SUMMARY OF TRAVERSE READINGS

JOB NAME: Forest Lake High School  
 LOCATION: \_\_\_\_\_  
 NWS PROJECT #: R 4539  
 TECHNICIAN: Tom Cederberg

DATE: 03/05/12-03/09/12  
 DRAWING NO: \_\_\_\_\_  
 DRAWING DATE: \_\_\_\_\_  
 PAGE 56 OF 60

SYSTEM: HU-7 SERVING \_\_\_\_\_

TRAVERSE NO.	DUCT SIZE	FREE AREA	DES FPM	DES CFM	% OF REQ.	ACT FPM	ACT CFM	C/L S.P.	REMARKS
O.A.	40" x 18"	5				175	875		40% Pilot
Return	72" x 12"	6				212	1272		Velgrid
Total							2147		

**COMMENTS:**



# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_

DRAWING NO: \_\_\_\_\_

NWS PROJECT #: R 4539

DRAWING DATE: \_\_\_\_\_

TECHNICIAN: Tom Cederberg

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SYSTEM: HU-8

SERVING: Boys Locker Room

LOCATION: South Mezz/Gym

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:		INLET PRESSURE:	
MODEL NO:		DISCHARGE PRESSURE	
TYPE:			
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	2 / 16"x90" 1 pc.	FAN SHEAVE:	14" x 1-11/16"
		MOTOR SHEAVE:	6" x 1-1/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	25-1/2"
MANUFACTURER:	Tag Painted	BELT SIZE/QUANTITY:	BX80 x 2
FRAME:	213T		
HORSEPOWER:	7.5 HP		
SERVICE FACTOR:			
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	6888
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	No outside air
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:	1755	RPM	
VOLTAGE/PHASE:	230/460 3-phase	VOLTS	
AMPERAGE/PHASE:	Painted	AMPS	
BRAKE HORSEPOWER:		BHP	
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 58 OF 60

SYSTEM: HU-8 SERVING

[illegible]

# FAN EQUIPMENT

JOB NAME: Forest Lake High School

DATE: 03/05/12-  
03/09/12

LOCATION: \_\_\_\_\_  
NWS PROJECT #: R 4539  
TECHNICIAN: Tom Cederberg

DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 59 OF 60

SYSTEM: HU-9 SERVING: Girls Locker Room  
LOCATION: North Mezz/Gym

<b>FAN DATA:</b>		<b>FAN STATIC PRESSURES:</b>	
MANUFACTURER:	McQuay	INLET PRESSURE:	
MODEL NO:	Tag Not	DISCHARGE PRESSURE	
TYPE:	Readable		
SERIAL NO:		<b>DRIVE COMPONENTS:</b>	
NO FILTERS/TYPE/SIZE:	2 / 16"x120"	FAN SHEAVE:	11-1/4" x 1-11/16"
		MOTOR SHEAVE:	4-1/2" x 1-1/8"
<b>MOTOR DATA:</b>		CENTER TO CENTER DIST:	22-1/4"
MANUFACTURER:	Marathon	BELT SIZE/QUANTITY:	BX-67
FRAME:			
HORSEPOWER:	Tag Not Readable		
SERVICE FACTOR:			
<b>STARTER DATA:</b>		<b>HEATER DATA:</b>	
MANUFACTURER:		SIZE:	
STARTER SIZE:		RATING:	

## MEASURED PERFORMANCE DATA:

ITEM	DESIGN	UNITS	ACTUAL
SYSTEM TOTAL CFM:		CFM	7013
RETURN AIR CFM:		CFM	
OUTDOOR AIR CFM:		CFM	No outside air
OUTLET TOTAL CFM:		CFM	
T.F.S.P.:		IN/WATER	
FAN RPM:		RPM	
MOTOR RPM:		RPM	
VOLTAGE/PHASE:		VOLTS	
AMPERAGE/PHASE:		AMPS	
BRAKE		BHP	
HORSEPOWER:			
CFM BY:			
DUCT TRAVERSE:			
FLOWHOOD:			
TSI HOT WIRE:			
ROTATING VANE:			
ADM 870			

## SUMMARY OF TRAVERSE READINGS

JOB NAME:	Forest Lake High School
LOCATION:	
NWS PROJECT #:	R 4539
TECHNICIAN:	Tom Cederberg

DATE: 03/05/12-03/09/12  
DRAWING NO: \_\_\_\_\_  
DRAWING DATE: \_\_\_\_\_  
PAGE 60 OF 60

SYSTEM: HU-9 SERVING Girls Locker Room

[illegible]

**Mechanical Systems Indoor Air Quality Study for**

**Forest Lake High School**

**Independent School District #831**

DLR Group has completed an evaluation of the Forest Lake High School Building mechanical systems. The purpose of the evaluation was to determine the ventilation rates available to the occupants by the existing ventilation systems. A certified balancing technician completed the quantitative readings of the existing ventilation system's performance.

The actual existing system ventilation rates are found in the tables of this report. The existing heating ventilating equipment do not have the capacity to provide the required ventilation rates for occupants as established by the ASHRAE 62 standards in all seasons of the year.

All elements of the ventilation system are not code compliant to the latest Minnesota State Codes.

The ventilation system that is being considered for this project consists of (4) steam fired air handling units. All of this equipment has out lived their useful life for effective ventilation. With no exceptions the air handling equipment does not provide the filtration recommended for schools per 123B.72. The equipment is currently fitted with 20% efficient filters the minimum requirement per ASHRAE is 65%.

None of the major ventilation control systems are capable of controlling and monitoring the volume of outside air. The major control devices are beyond repair and must be replaced.

**The Project Description**

The intent of this project is to replace, update and remediate the existing ventilation systems to restore the quality of indoor air to an acceptable level. This may be accomplished by means of new heating and ventilation equipment and duct and piping distribution system modifications. The project design upgrades the ventilation systems to provide the ventilation rates as required by the Minnesota Mechanical Code and ASHRAE 62 of between 15 to 30 CFM per occupant as determined by the space use and occupancy.

The ventilation rates will be increased to 15 CFM for classrooms and 20 CFM for offices as required by the ASHRAE standards.

The High School Building project will replace the existing deficient air handling system with components that provide the proper air quality for the school occupants. The units will be fitted with DDC controls by expanding the existing Building automation system to receive the new control requirements. The project will be commissioned to assure that the design intent has been properly executed.

### **The Project Work Scope**

The project consists of demolition of the existing outdated air handling equipment components and replacing the equipment with components capable of providing the design ventilation rates. The replacement of the mechanical system components will require incidental architectural and structural modifications that are required to complete the mechanical installations. The existing DDC control logic systems will be expanded to include the new mechanical equipment and systems.

Included in this work is replacing the existing controls with modern control components with the capability to provide the required ventilation rates. The components included are the outside air damper assembly and filtration necessary to provide the required ventilation and filtration. These modified systems will provide the proper required ventilation for the occupants.

The existing building automation systems will be expanded to accept the new equipment and control functions required to properly ventilate the building.

The project will include commissioning of the new mechanical installations and systems.

### **The Spaces That the Project Will Address**

The project will correct the deficiencies in the ventilation systems in the "A","B" and "C" wings of the building consisting of classrooms and media center.

### **Design Criteria**

The project intent is to increase the ventilation rates to 15 CFM per occupant for classrooms and 20 CFM per occupant for offices. These rates are as required by ASHRAE 62 standards.

The systems will be designed to be compliant to the latest Minnesota Mechanical code.

The areas of the building under consideration are at the end of this report.

### **High School Building Ventilation System Deficiencies**

#### **Classroom**

The classrooms are served with multiple air handling systems. These systems are comprised of constant volume multizone, constant volume with reheat, or constant volume dual duct systems. The units are not capable of providing the proper ventilation in all seasons to the occupants due to limited control capability and insufficient supply fan and coil capacity. In some instances the units are not even operational. As a result, these units do not introduce the correct amount of outside air during non-economizer modes of operation which is the majority of the school year.

The filtration of these units presently is at minimal levels. The existing filtration of the unit ventilator is less than 20% efficient. Current standards call for 65% efficient filtration.

In normal operation the ventilation rates provided are significantly below the standards.

### Media Center

The media center is a constant volume with reheat system. The unit is not capable of providing the proper ventilation in all seasons to the occupants due to limited control capability and insufficient supply fan and coil capacity. In some instances the units are not even operational. As a result, these units do not introduce the correct amount of outside air during non-economizer modes of operation which is the majority of the school year.

The filtration of these units presently is at minimal levels. The existing filtration of the unit ventilator is less than 20% efficient. Current standards call for 65% efficient filtration.

Under normal operation the ventilation rates provided are significantly below the standards.

### Exhaust Systems

The toilet exhaust systems are not of proper size and configuration to properly exhaust the areas served by the fans. Many of the janitor's closets and cleaning chemical storage spaces are not ventilated. The existing fans do not properly exhaust the spaces due to the age and condition of the existing fans.

### Recommendations

A new induction displacement ventilation system will be installed in most of the classrooms and media center. The systems will be designed to meet or exceed ASHRAE 62-2007 requirements.

The induction displacement system will be served by dedicated 100% Outside Air (DOAS) variable air volume air conditioning unit with relief fan, and an energy recovery wheel. These units have a supply fan, relief fan, filters, heating and cooling coil, and an energy recovery wheel. The minimum outside air requirements to be delivered to the occupied spaces are met by these units. This unit delivers air to induction units at a temperature ranging from 55 to 63 degrees. The induction units, in turn, deliver the air, at low velocity, to the classrooms. The induction units deliver air to the space at a 2:1 supply ratio. This means for every 400 cfm supplied to the unit, another 800 cfm of air will be "induced" into the space, resulting in 1,200 cfm of air delivered to the space. Supplemental heating and cooling is accomplished at the induction units which are located along the exterior perimeter. This system is commonly known as a displacement ventilation system. An effective displacement ventilation system will allow for the cooler air to be delivered low in the occupied zone and will allow natural thermal convection to warm the air as it rises. As the distance from the floor increases, so does the temperature of the air. The air at the ceiling may be as warm as 85 degrees, while the occupied zone is 75 degrees. This is commonly referred to as thermal stratification. The warm air is then returned to the corresponding air handling unit. The warm air is exhausted at the air handling unit. To allow for displacement ventilation to work, the air



Mechanical Systems Indoor Air Quality Study for  
Forest Lake High School Building  
Independent School District #831

must have room to stratify. Operating in series with these air handling units are the induction units. The amount of air necessary to heat or cool a space, on a design day, is greater than the outside air quantity delivered to the space. The induction units make up the difference, with respect to quantity of air needed, between what is needed to heat or cool the space and the outside air being delivered. The intent is to deliver air to the space at a temperature 3 degree below space temperature setpoint. In the cooling season, the cool air will provide thermal comfort in the occupied zone. Above the occupied zone, the warm air will pool; this stratification allows for smaller mechanical cooling equipment to be required to meet the cooling demands of the building. In the heating season, the air will once again provide thermal comfort to the occupied zone by overcoming the heating load produced by the occupants. The temperature of the air delivered from the induction units will, at times, be greater than 68 degrees in order to meet the heating load of the occupied space. To reduce the energy consumption needed to condition the outside air for these facilities, the design includes the use of energy recovery components. The air handler is fitted with an energy recovery wheel heat exchanger. The air-handling unit is designed to operate during all non-economizing outside conditions. The energy recovery system heat exchanger use the air exhausted from spaces that the units serve to accomplish in the pre-conditioning of the outside air. The air stream is then heated as required to the discharge air temperature setpoint. At this point, the air is delivered to the displacement ventilation system at 68 db/55 wb, allowing thermal comfort and humidity to be maintained.

**Component Costs to Remodel vs. Replace with New Construction**

Demolish and replace ventilation systems and minor asbestos abatement as recommended and bring systems up to code:

Project Costs = \$3,100,000. (These costs could be submitted to the Dept. of Education and qualify for Health & Safety and/or Alternative Bonding Funds.)

Replace the same square footage building on the same site with new construction:

Project Costs = \$50,000,000. (None of these dollars would qualify for Health & Safety and/or Alternative Bonding Funds.)



Mechanical Systems Indoor Air Quality Study for  
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DLR Group Project No. 40-112120-00		Date: July 19, 2012 Revision No.: 1		Forest Lake High School Induction Displacement System			
	DESCRIPTION	QUANTITY	UNITS	UNIT COST	EXTEND COST	ALT. FACILITIES COST	CAPITAL COST
DEMOLITION							
AIR HANDLING SYSTEM							
	Demo existing system	108200	sq. ft	\$0.75	\$ 81,150.00	\$ 81,150.00	
	Asbestos abatement	1	EACH	\$ 15,000.00	\$ 15,000.00	\$ 15,000.00	
	Demo existing ductwork	1	EACH	\$ 10,000.00	\$ 10,000.00	\$ 10,000.00	
	Demo Controls	1	EACH	\$ 10,000.00	\$ 10,000.00	\$ 10,000.00	
	Demo Electrical and special systems to existing equipme	1	EACH	\$ 15,000.00	\$ 15,000.00	\$ 15,000.00	
DEMOLITION TOTAL						\$ 131,150	
NEW CONSTRUCTION WORK							
	Induction Displacement Units	150	EACH	\$ 3,000.00	\$ 450,000.00	\$ 450,000.00	
	Induction Units Cover Panels	140	EACH	\$ 200.00	\$ 28,000.00	\$ 28,000.00	
	Cabinet Unit Heater	10	EACH	\$ 1,000.00	\$ 10,000.00	-	\$ 10,000.00
	Fire Smoke dampers	20	EACH	\$ 500.00	\$ 10,000.00	\$ 10,000.00	
	Piping to connect induction displacement units	108200	sq ft	\$ 5.00	\$ 541,000.00	\$ 541,000.00	
	Ductwork from AHU-01 to Induction displacement Units	108200	sq ft	\$ 1.00	\$ 108,200.00	\$ 108,200.00	
	VAV boxes	60	EACH	\$ 1,500.00	\$ 90,000.00	\$ 90,000.00	
	Grilles Registers Diffusers	240	EACH	\$ 100.00	\$ 24,000.00	\$ 24,000.00	
	AHU-1-4 w/dehumidification	65000	cfm	\$ 10.00	\$ 650,000.00	\$ 650,000.00	
	Energy Recovery for AHU-01, 02	65000	cfm	\$ 2.00	\$ 130,000.00	-	\$ 130,000.00
	Ceiling/lighting Replacements	50000	sq ft	\$ 3.00	\$ 150,000.00	-	\$ 150,000.00
	Electrical Connect new AHU's	108200	sq ft	\$ 1.00	\$ 108,200.00	\$ 108,200.00	
	Temperature controls including Dehumidification	108200	sq ft	\$ 3.00	\$ 324,600.00	\$ 324,600.00	
	Testing, Adjusting and Balancing	108200	sq ft	\$ 0.50	\$ 54,100.00	\$ 54,100.00	
NEW CONSTRUCTION COST						\$ 2,388,100.00	\$ 290,000.00
BUILDING TOTAL						\$ 2,519,250.00	\$ 290,000.00
PROJECT CONTINGENCY (5%)						\$ 125,962.50	\$ 14,500.00
COST ESCALATION (3%) to summer 2013						\$ 75,577.50	\$ 8,700.00
TOTAL CONSTRUCTION COST						\$ 2,720,790.00	\$ 313,200.00
PROFESSIONAL SERVICES							
	A/E fees including study	1	EACH	\$ 242,719	\$ 242,719.20		
	Commissioning Fees for entire facility	108,500	sq ft	\$ 1.00	\$ 108,500.00		
	Reimbursables Estimate (printing, permits)	1	EACH	\$ 25,000.00	\$ 25,000.00		
TOTAL PROFESSIONAL SERVICES						\$ 376,219	
TOTAL PROJECT COST PHASE 1						\$ 3,097,009.20	\$ 313,200.00

## Testing Data

The following chart is a summary of the air-handling testing information. Due to the extremely unusual spring (Testing occurred on March 5- March 9, 2012 when the average outside air temperature for the week was 48 deg. F.) all the testing occurred when the units were in economizer mode. This abnormality has skewed the test results. DLR Group has calculated the required amount of outside air and compared with the heating coil information to highlight that the systems are not capable of delivering the required amount of outside air year round. These facts are causing significant occupant complaints from the occupants of the Forest Lake High School that the Forest Lake School District would like to resolve with a Ventilation upgrade project.

Mechanical Systems Indoor Air Quality Study for  
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**AHU-1 CLASSROOMS**

AIRFLOW

33,310 CFM UNIT

HEATING COIL CAP

1,000,000 BTU/HR

Room	People	CFM/person	Total OA req'd
A100	45 PEOPLE	15	675
A101	30 PEOPLE	15	450
A102	30 PEOPLE	15	450
A103	30 PEOPLE	15	450
A104	30 PEOPLE	15	450
A105	30 PEOPLE	15	450
A106	30 PEOPLE	15	450
A107	30 PEOPLE	15	450
A108	30 PEOPLE	15	450
A109	45 PEOPLE	15	675
A110	30 PEOPLE	15	450
A111	30 PEOPLE	15	450
A112	30 PEOPLE	15	450
A113	30 PEOPLE	15	450
A114	21 FIXTURES	50 EA	1050
A115	60 PEOPLE	15	900
A116	600 SF	0.5 EA	300
A117	60 PEOPLE	15	900
A118	60 PEOPLE	15	900
A119	30 PEOPLE	15	450
A120	2 PEOPLE	20	40
A121	2 PEOPLE	20	40
A122	300 SF	0.5 EA	150
A123	30 PEOPLE	15	450
A124	2 PEOPLE	20	40
A125	1000 SF	0.5 EA	500
A126	1000 SF	0.5 EA	500
A127	1000 SF	0.5 EA	500
<b>TOTAL OUTSIDE AIR CFM REQUIRED</b>			<b>13470</b>
MAXIMUM OUTSIDE AIR QUANTITY UNIT COILS CAN CONDITION			11,000
PERCENT OF OUTSIDE AIR REQUIRED			82%

Mechanical Systems Indoor Air Quality Study for  
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**AHU-2 ADMINISTRATION**

AIRFLOW

6,650 CFM UNIT

HEATING COIL CAP

200,000 BTU/HR

Room	People	CFM/person	Total OA req'd
B100	5 PEOPLE	20	100
B101	5 PEOPLE	20	100
B102	5 PEOPLE	20	100
B103	30 PEOPLE	20	600
B104	5 PEOPLE	20	100
B105	5 PEOPLE	20	100
B106	5 PEOPLE	20	100
B107	5 PEOPLE	20	100
B108	5 PEOPLE	20	100
B109	5 PEOPLE	20	100
B110	5 PEOPLE	20	100
B111	5 PEOPLE	20	100
B112	5 PEOPLE	20	100
B113	5 PEOPLE	20	100
B114	5 PEOPLE	20	100
B115	5 PEOPLE	20	100
B116	10 PEOPLE	20	200
B117	5 PEOPLE	20	100
B118	5 PEOPLE	20	100
B119	10 PEOPLE	20	200
B120	5 PEOPLE	20	100
B121	2 FIXTURES	50 EA	100
B122	2 FIXTURES	50 EA	100
B123	2 FIXTURES	50 EA	100
B124	2 FIXTURES	50 EA	100
B125	500 SF	0.5 EA	250
B126	20 PEOPLE	20	400

**TOTAL OUTSIDE AIR CFM REQUIRED**

**3850**

MAXIMUM OUTSIDE AIR QUANTITY UNIT COILS CAN CONDITION

2,500

PERCENT OF OUTSIDE AIR REQUIRED

65%

Mechanical Systems Indoor Air Quality Study for  
Forest Lake High School Building  
Independent School District #831

**AHU-3 MEDIA CENTER**

AIRFLOW

13,000 CFM UNIT

HEATING COIL CAP

500,000 BTU/HR

Room	People	CFM/person	Total OA req'd
B127	3000 SF	0.5 EA	1500
B128	1000 SF	0.5 EA	500
B129	2000 SF	0.5 EA	1000
B130	100 PEOPLE	15	1500
B131	20 PEOPLE	15	300
B132	10 PEOPLE	15	150
B133	60 PEOPLE	15	900
B134	10 PEOPLE	20	200
B135	10 PEOPLE	20	200
<b>TOTAL OUTSIDE AIR CFM REQUIRED</b>			<b>6250</b>
MAXIMUM OUTSIDE AIR QUANTITY UNIT COILS CAN CONDITION			5,250
PERCENT OF OUTSIDE AIR REQUIRED			84%

# Mechanical Systems Indoor Air Quality Study for Forest Lake High School Building Independent School District #831

## AHU-4 CLASSROOMS

AIRFLOW

42,550 CFM UNIT

HEATING COIL CAP

1,500,000 BTU/HR

Room	People	CFM/person	Total OA req'd
C100	30 FIXTURES	50 EA	1500
C101	2000 SF	0.5 EA	1000
C102	30 PEOPLE	15	450
C103	10 PEOPLE	20	200
C104	20 PEOPLE	15	300
C105	5 PEOPLE	20	100
C106	5 PEOPLE	20	100
C107	30 PEOPLE	15	450
C108	30 PEOPLE	15	450
C109	30 PEOPLE	15	450
C110	45 PEOPLE	15	675
C111	30 PEOPLE	15	450
C112	30 PEOPLE	15	450
C113	30 PEOPLE	15	450
C114	20 PEOPLE	15	300
C115	30 PEOPLE	15	450
C116	30 PEOPLE	15	450
C117	5 PEOPLE	20	100
C118	5 PEOPLE	20	100
C119	2000 SF	0.5 EA	1000
C120	600 SF	0.5 EA	300
C121	30 PEOPLE	15	450
C122	30 PEOPLE	15	450
C123	30 PEOPLE	15	450
C124	30 PEOPLE	15	450
C125	30 PEOPLE	15	450
C126	30 PEOPLE	15	450
C127	30 PEOPLE	15	450
C128	30 PEOPLE	15	450
C129	30 PEOPLE	15	450
C130	90 PEOPLE	15	1350
C131	30 PEOPLE	15	450
C132	30 PEOPLE	15	450
C133	30 PEOPLE	15	450
C134	30 PEOPLE	15	450
C135	3000 SF	0.5 EA	1500
C136	4000 SF	0.5 EA	2000
C137	2000 SF	0.5 EA	1000
C138	30 PEOPLE	15	450
C139	30 PEOPLE	15	450
C140	30 PEOPLE	15	450
C141	30 PEOPLE	15	450
C142	45 PEOPLE	15	675
C143	15 PEOPLE	15	225
C144	45 PEOPLE	15	675
C145	45 PEOPLE	15	675
C146	30 PEOPLE	15	450
C147	30 PEOPLE	15	450
C148	30 PEOPLE	15	450
C149	30 PEOPLE	15	450
C150	30 PEOPLE	15	450
C151	30 PEOPLE	15	450
C152	30 PEOPLE	15	450
C153	30 PEOPLE	15	450
C154	30 PEOPLE	15	450
C155	5 PEOPLE	15	75
C156	30 PEOPLE	15	450

**TOTAL OUTSIDE AIR CFM REQUIRED**

**30050**

MAXIMUM OUTSIDE AIR QUANTITY UNIT COILS CAN CONDITION

17,000

PERCENT OF OUTSIDE AIR REQUIRED

57%