DOVER SCHOOL DISTRICT

JOINT BUILDING COMMITTEE – DOVER HIGH SCHOOL AND REGIONAL CTC MEETING NOTICE

Meeting Type:	**Regular Meeting**
Meeting Location:	**Superintendent's Conference Room, McConnell Center**
Meeting Date:	**Tuesday, October 13, 2015**
Meeting Time:	**4:30 P.M.**

1. Call to order and roll call
2. Citizens' Forum
3. Approval of Meeting Minutes from Sept. 29, 2015
4. Financial Report
    a. Authorizations
5. Approve September Status Report and Financial Report to be submitted to the city council and school board.
6. Review building systems-HVAC and Technology/GGD
7. Update on plans and site plan
8. Review future meeting schedule
9. Matters of Interest
10. Build next agenda and review action items
11. Adjournment

MAN. NO. CIPM#DHSCTC011
DATE: 10/6/2015

VENDOR VOUCHER MANIFEST
SCHOOL DISTRICT SAU #11

1. DATE	2. PAYEE NAME AND ADDRESS	3. FINANCE PO NO:	4. AMOUNT EXPENDED	5. AMOUNT OF CHECK	6. PROJECT NAME
1. 10/6/2015	HMFH Architects, Inc. 130 Bishop Allen Drive Cambridge, MA 02139				DHS/CTC Fac. Improv.
	4016.1.600.46900.4725.07101.16.000.000.700	201603137		$ 268,128.00	FY: 2016
	4016.1.600.46900.4725.07108.16.000.000.700	201603137		$ 84,672.00	
	Invoice #850, Schematic Design				
TOTALS				**$352,800.00**	

TO THE TREASURER; PAYMENTS AUTHORIZED AND ORDERED
TO THE PERSONS LISTED ABOVE FOR THE SUMS INDICATED
IN COLUMN 5. AMOUNT OF CHECK AMOUNTING IN THE
AGGREGATE TO: 352,800.00

Superintendent of Schools or Business Administrator ***Date***

Robert Carrier, Deputy Mayor, JBC Chair ***Date***

HMFH Architects, Inc.
130 Bishop Allen Drive
Cambridge, MA 02139
t 617 492 2200
f 617 876 9775
www.hmfh.com

Dover NH School District
McConnell Center
61 Locust Street, Ste 409
Dover NH 03820

Attention: Karen M. Taylor, Business Admin.

Invoice # : 850
Project : 403114
Project Name : Dover High School & RTC
Invoice Date : 10/6/2015

For Professional Services Rendered through September 30, 2015

Phase Name		Phase Fee	Previous Amount	Current Amount	% Complete	Total Fee Earned
Feasibility Study		485,000.00	485,000.00	0.00	100.00	485,000.00
Schematic Design		1,008,000.00	151,200.00	352,800.00	50.00	504,000.00
Design Development		1,344,000.00	0.00	0.00	0.00	0.00
Construction Documents		1,680,000.00	0.00	0.00	0.00	0.00
Bidding/Negotiations		336,000.00	0.00	0.00	0.00	0.00
Construction Administration		1,999,200.00	0.00	0.00	0.00	0.00
Construction Admin Phase 2		352,800.00	0.00	0.00	0.00	0.00
Visioning/Educ Plan Proc. (PSS1)		29,150.00	29,150.00	0.00	100.00	29,150.00
	Total Fee:	7,234,150.00				

Total Fee Earned To Date	1,018,150.00
Less Previous Billings	665,350.00
Amount Due This Invoice	352,800.00

MAN. NO. CIPM#DHSCTC012
DATE: 10/9/2015

VENDOR VOUCHER MANIFEST
SCHOOL DISTRICT SAU #11

1. DATE	2. PAYEE NAME AND ADDRESS	3. FINANCE PO NO:	4. AMOUNT EXPENDED	5. AMOUNT OF CHECK	6. PROJECT NAME
1. 10/9/2015	PC Construction 193 Tilley Drive South Burlington, VT 05403				DHS/CTC Fac. Improv.
	4016.1.600.46900.4725.07101.16.000.000.700	201602368		$ 44,840.00	FY: 2016
	4016.1.600.46900.4725.07108.16.000.000.700	201602368		$ 14,160.00	
	Invoice #150271-001				
TOTALS				**$59,000.00**	

TO THE TREASURER; PAYMENTS AUTHORIZED AND ORDERED
TO THE PERSONS LISTED ABOVE FOR THE SUMS INDICATED
IN COLUMN 5. AMOUNT OF CHECK AMOUNTING IN THE
AGGREGATE TO: 59,000.00

Superintendent of Schools or Business Administrator ***Date***

Robert Carrier, Deputy Mayor, JBC Chair ***Date***

CONSTRUCTION

Construction Invoice

193 Tilley Drive, South Burlington, VT 05403 | 802.658.4100

Invoice Number: 150271-001

Date: 9/2/15

Project Number: 150271

Requisition Number: 001

To: Dover School District
ATTN: Karen Taylor
61 Locust Street, Suite 409
Dover, NH 03820

Project	Location	Client Reference	Terms
150271	Dover, NH	Dover HS and CTC Renovations	Net 30

Description of Work:

Preconstruction Phase I estimating services covering the initial 3 conceptual design option estimates and reconcilliation with HMFH Estimator.

Total this invoice:

$59,000

cc: Melissa Glidden
Joseph Picoraro
PCC Accounts Receivable

CAPITAL IMPROVEMENTS SUMMARY
Dover High School & Regional Career Technical Center Project
As of: September 30,2015

Appropriation #1 (FY14), Issued January 26, 2014:	$	900,000.00
Appropriation #2 (FY15), Issued November 12, 2014:	$	23,300,000.00
Appropriation #3 (FY16), Issued July 22, 2015:	$	49,700,000.00
State of NH Funding (FY16):	$	13,500,000.00
Total Appropriation:	**$**	**87,400,000.00**

Date	***CIPM#***	***Expenditures to Date:***		***Amount:***
2/26/2015	001	HMFH Architects, Inc.: Feasibility Study - for services rendered through 12/31/2014	$	24,250.00
2/26/2015	001	HMFH Architects, Inc.: Feasibility Study & Visioning /Educ Plan Proc. - for services rendered through 1/31/2015	$	106,100.00
3/12/2015	002	HMFH Architects, Inc.: Travel Expense - for services rendered through 12/31/2014	$	347.94
3/12/2015	002	HMFH Architects, Inc.: Travel Expense - for services rendered through 1/31/2015	$	238.23
3/26/2015	003	HMFH Architects, Inc.: Feasibility Study - for services rendered through 2/28/2015	$	82,450.00
3/26/2015	003	HMFH Architects, Inc.: HazMat - for services rendered through 2/28/2015	$	6,270.00
3/26/2015	003	HMFH Architects, Inc. - Travel Expense - for services rendered through 2/28/2015	$	548.74
4/30/2015	004	HMFH Architects, Inc.: Feasibility Study & Visioning /Educ Plan Proc. - for services rendered through 3/31/2015	$	87,950.00
4/30/2015	004	HMFH Architects, Inc.: Survey - for services rendered through 3/31/2015	$	37,730.00
4/30/2015	004	HMFH Architects, Inc.: Printing & Travel Expense - for services rendered through 3/31/2015	$	5,204.68
6/18/2015	005	HMFH Architects, Inc.: Feasibility Study - for services rendered through 4/30/2015	$	82,450.00
6/18/2015	005	HMFH Architects, Inc.: GeoTech/GeoEnv - for services rendered through 4/30/2015	$	4,001.75
6/18/2015	005	HMFH Architects, Inc.: Travel Expense - for services rendered through 4/30/2015	$	279.66
6/30/2015	006	HMFH Architects, Inc.: Feasibility Study - for services rendered through 5/31/2015	$	82,450.00
6/30/2015	006	HMFH Architects, Inc.: GeoTech/GeoEnv - for services rendered through 5/31/2015	$	2,184.93
6/30/2015	006	HMFH Architects, Inc.: Travel Expense - for services rendered through 5/31/2015	$	71.23
6/30/2015	006	HMFH Architects, Inc.: Feasibility Study - for services rendered through 6/30/215	$	24,250.00
6/30/2015	006	HMFH Architects, Inc.: GeoTech/GeoEnv - for services rendered through 6/30/2015	$	15,195.13
6/30/2015	006	HMFH Architects, Inc.: Travel Expense - for services rendered through 6/30/2015	$	938.83
6/30/2015	008	Journal entry to re-class JBC expenses from GF (managed under existing POs & Payroll within GF)	$	14,527.35
9/3/2015	007	HMFH Architects, Inc.: Feasibility Study - for services rendered through 7/31/2015	$	24,250.00
9/3/2015	007	HMFH Architects, Inc.: Travel Expense - for services rendered through 7/31/2015	$	181.94
		Total:	**$**	**601,870.41**

Obligations:		
PC Construction Co.: Preconstruction Phase for DHS/CTC renovation	$	96,000.00
HMFH Architects, Inc.: Supplement #3 Services Fee authorized 9/15/2015	$	6,720,000.00
HMFH Architects, Inc.: Additional Geotechnical Engineering Services-Borings, Geotechnical Report & Design	$	40,700.00
HMFH Architects, Inc.: Printing & Travel Expenses - for services rendered through 8/31/2015	$	1,895.89
	$	**6,858,595.89**

Budget Availability: **$79,939,533.70**

HVAC Systems Overview

For Dover High School

Dover, NH

GARCIA • GALUSKA • DESOUSA
Consulting Engineers Inc.

Life Cycle Cost Analysis HVAC System Options

HVAC System Options Overview

1. **Baseline: VAV System (ASHRAE Baseline)**
2. **Option 1: Dehumidification Displacement System with DOAS**
3. **Option 2: Fully Air-Conditioned Displacement System with DOAS**
4. **Option 3: Induction Unit System with DOAS**

HVAC System Comparison

Mixing vs. Displacement Systems

AIR CONDITIONING

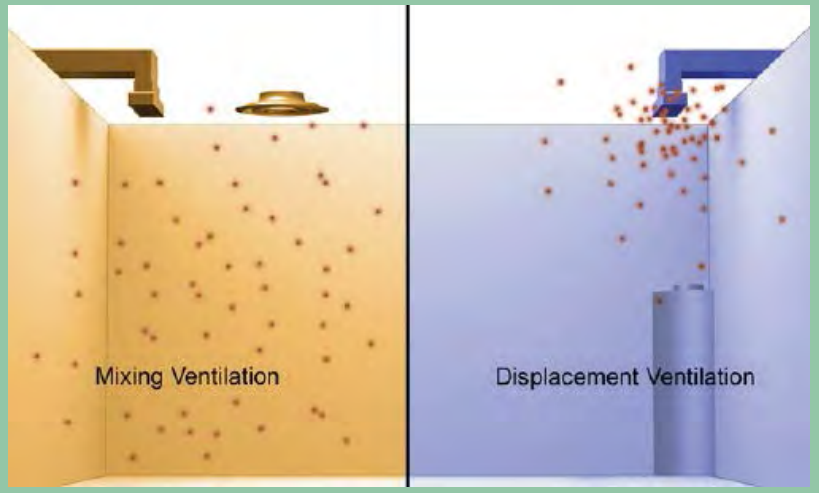
- VENTILATION AIR COOLED AND SUPPLIED AT 55 DEG F. TO SPACE
- MAINTAINS SPACE TEMP. AT 75 DEG F.
- ADDITIONAL EQUIP. REQD. WITH INCREASED CAP. TO MAINTAIN 75 DEG F.
- INCREASED DUCT SIZES OR NEED FOR ADDITIONAL PIPING SYSTEM
- INCREASED CONSTRUCTION COST BY 20-30% (Dependent upon AC System)
- INCREASED OPERATIONAL COST BY 25-30% (APPROX. $1.90/SF)

DEHUMIDIFIED AIR

- VENTILATION AIR COOLED BY DEHUMIDIFICATION AND REHEATED BY HOT GAS HEAT RECOVERY TO 68 DEG F.
- TEMP. FLOATS IN SPACE WITHIN COMFORT ZONE
- REDUCED DUCT SIZES OR NEED FOR SECONDARY EQUIPMENT
- REDUCED CONSTRUCTION COST WHEN COMPARED TO CONVENTIONAL NON-CONDITIONED BUILDINGS
- SIMILAR OPERATIONAL COST WHEN COMPARED TO CONVENTIONAL NON AIR CONDITIONED BUILDINGS (APPROX. $1.40/SF)

Displacement System (Classrooms, Cafeteria, Gymnasium, Corridors)

- Ventilation air is provided from high efficiency packaged gas-fired heat/DX cooling RTU w/ ERV
- Air is delivered at low velocity and at low levels within the space
- The system uses naturally occurring buoyant forces within the space to create a vertical rise of the air throughout the space.
- 2-4˚ F differential supply air to space
- Supply air rises when heat source is contacted
- Displaces room air upward
- Air rises with pollutants to ceiling
- Air returns at ceiling back to air handling unit



Mixed Systems
E_c= 0.8

DV Systems
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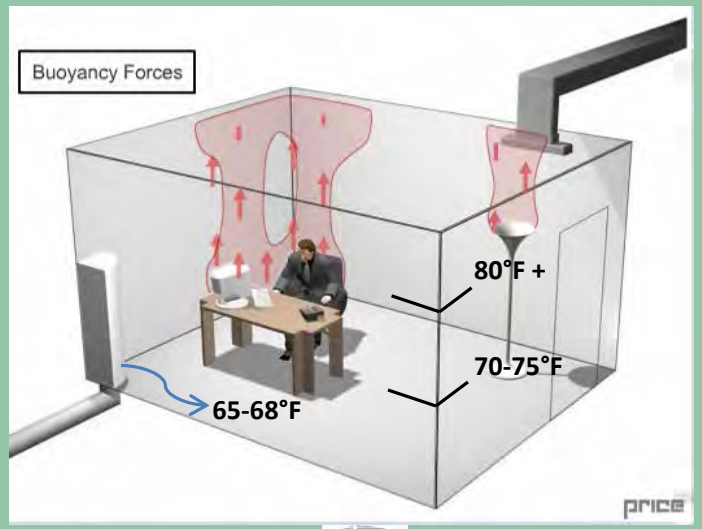


Displacement System

Pros:

- Excellent pollution removal
- Very low noise levels
- Very low air velocity
- Low moisture levels
- Reduced cooling loads
- Reduced initial cost
- Variable volume reheat is not required
- High ventilation effectiveness

Displacement Diffuser Options

Cons:

- Requires Perimeter Radiation Heating
- Dehumidification Only Design (Options 2 & 4) does not provide Cooling Setpoint temperature control

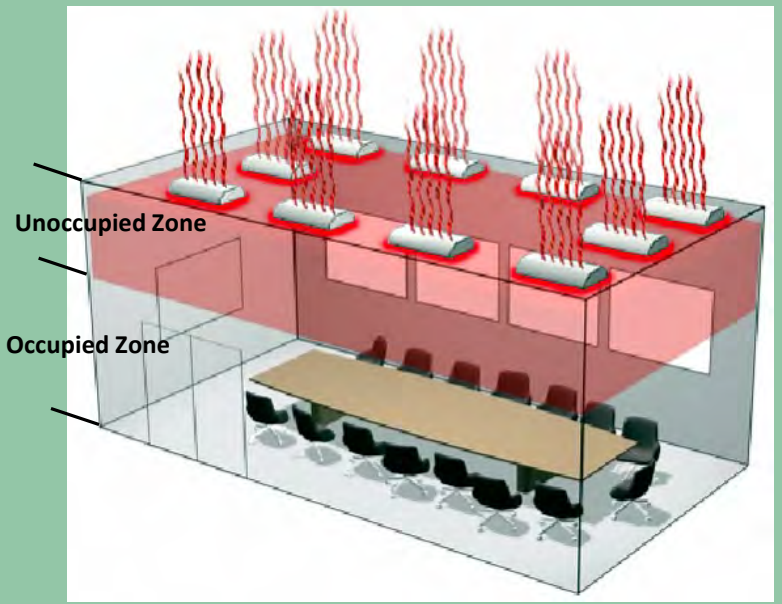
Displacement System – Energy Conservation

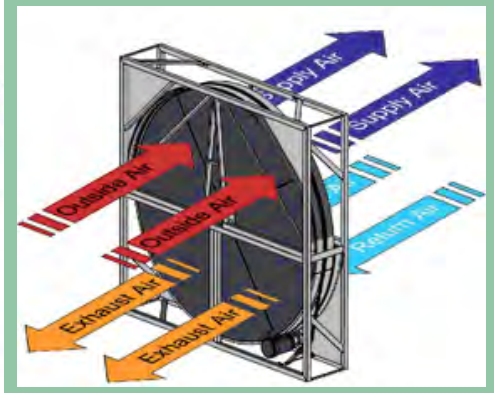
Load Calculation Reductions

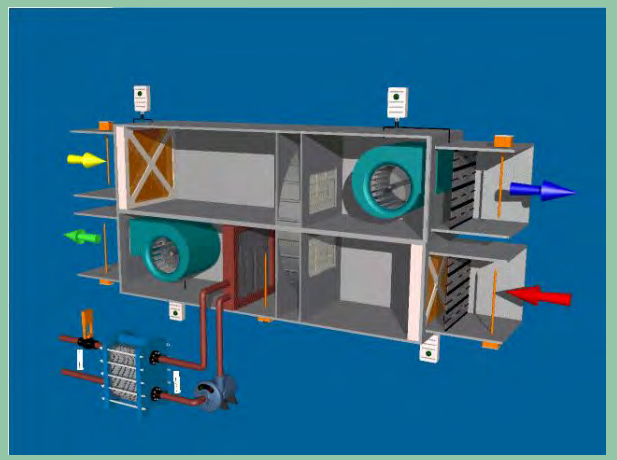
- Conventional System: All heat generated in room is included in air flow calculation since all airflow is mixed.
- Displacement System: Only loads which occur in the Occupied Zone are factored
- Results in: Smaller equipment & systems and lower installed and operating costs for Displacement Systems

Additional Energy Efficiency Measures

- Energy Recovery: Transfers energy from the return air stream to the supply air stream to pre-heat or pre-cool the outside air.
- Variable Air Volume w/ CO2 Demand Control Ventilation: Modulates the airflow to large single zone areas in accordance to space mounted thermostat and CO2 sensors reducing energy consumption due to reduced air changes.

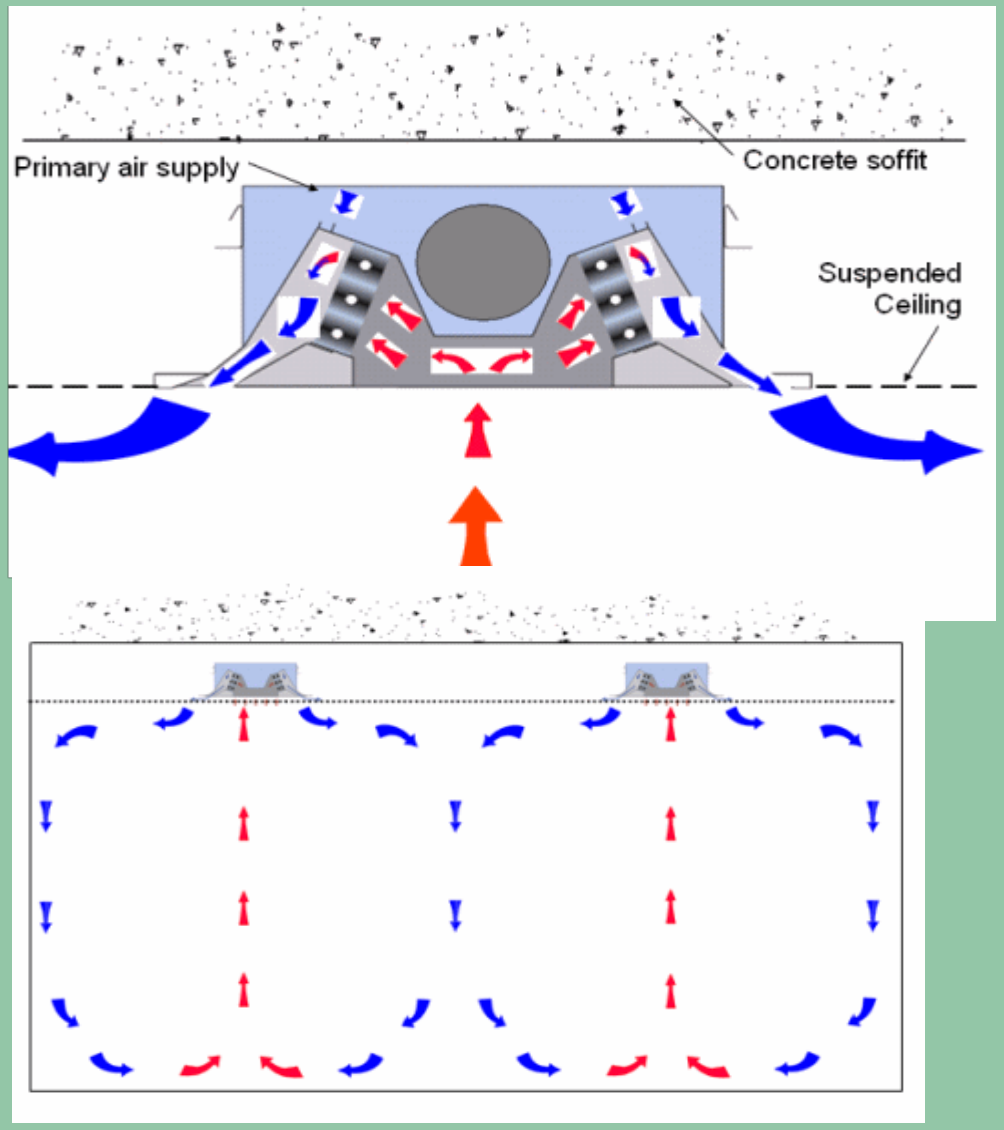






Induction Units (Administration)

- Ventilation air is provided from high efficiency packaged gas-fired heat/DX cooling RTU w/ ERV
- Primary (Ventilation) Air is supplied to plenum and discharges through nozzles
- Room air is induced through the heating/cooling coils
- Mixture of Primary and Room air is delivered to room through diffuser slots.
- Condensate drain pans and piping system for condensate removal



Induction Units

Pros:

- Energy efficient
- Low Noise Levels
- Flexibility of Installation
- Moderate first cost
- Simplified Controls (No Fans)
- Lower Maintenance (No Terminal Filters)

Cons:

- Requires increased coordination with “ceiling” system. (e.g. additional piping, HW, CHW & condensate piping)
- Requires additional ventilation air in some cases
- Increase Energy Consumption vs. Dehumidified Air System

High Efficiency Heating Hot Water and Chilled Water Plant

Boiler Plant

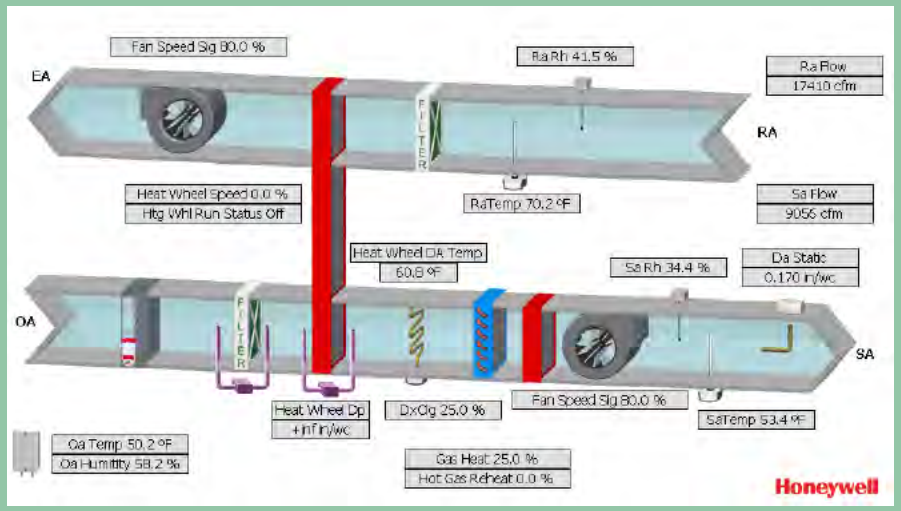
- High efficiency (90%+) gas-fired condensing boilers
- Boiler temperature reset controls
- Variable speed pumps with VFD's

Chiller Plant

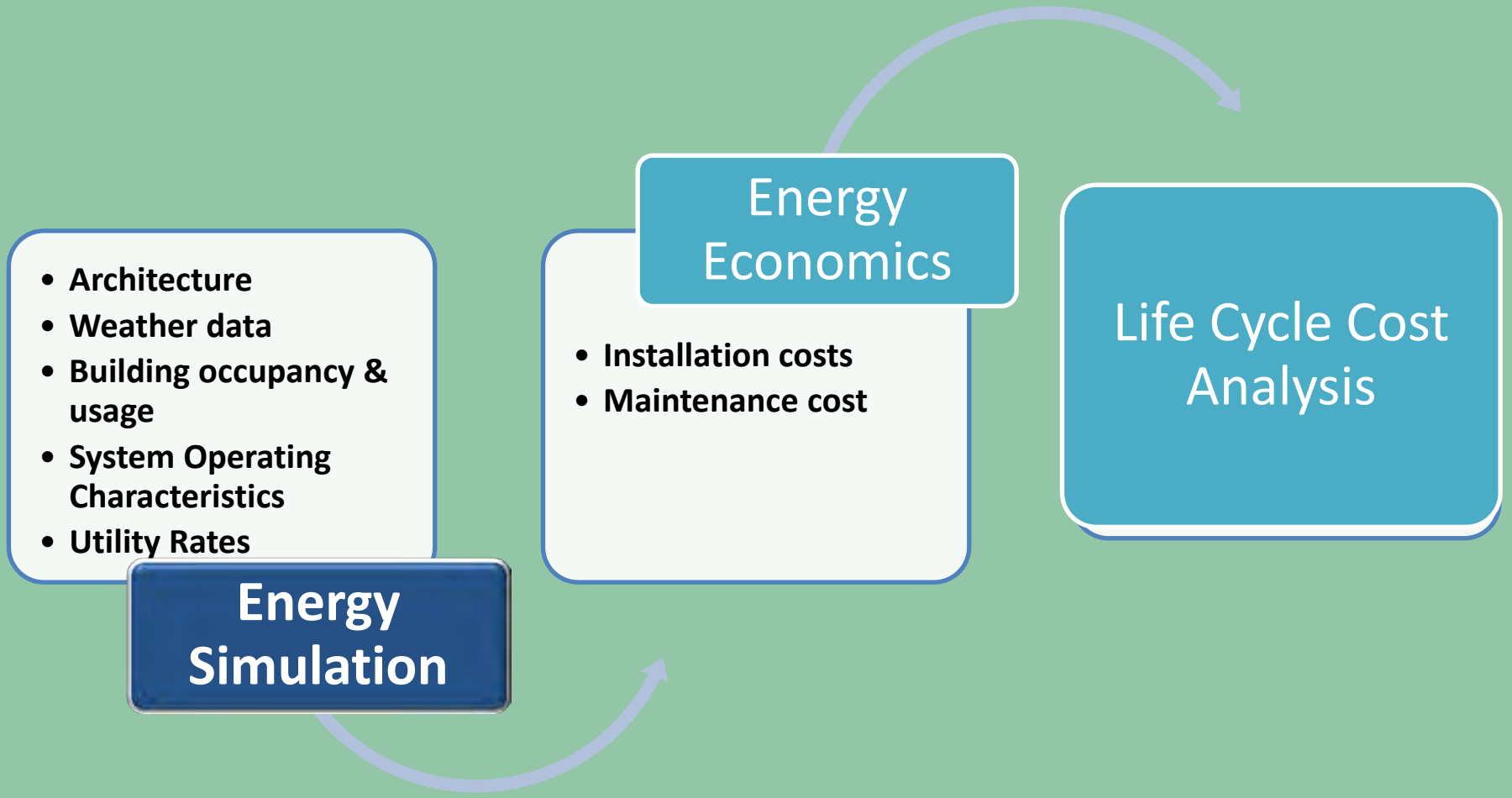
- High efficiency air-cooled chiller
- Chilled water temperature reset controls
- Variable speed pumps with VFD's

Building Automation and Energy Management System

- System (Zone) Scheduling
- Occupied-Unoccupied Control
- Night Setback Operation
- Lighting Control System Integration
- Increased Energy Savings
- Integrate with Preventative Maintenance Scheduling



Energy Economics Methodology



Energy Model Methodology

- Computer Simulation of Building Energy Usage using Department of Energy (DOE-2)/eQuest.
- Model consists of project specific:
- Architectural features (geometry, orientation, envelope)
- Local Weather Data
- Occupancy, Lighting, Equipment schedules
- HVAC System Data (specific to each system option)
- Local Utility Rates

Energy Economics Methodology

- Computer calculation of HVAC System economics utilizing NIST BLCC 5.
- Calculation factors:
  - HVAC System and Maintenance Cost Estimates
    - Prepared in house using recent project cost data and industry standard estimating references.
  - Standard Industry Discount, Inflation and Interest Rates

Example Summary of Results

Baseline	System	GROSS CAPITAL INVESTMENT*	ANNUAL ELEC. CONS. (KWH)	ANNUAL GAS CONS. (MBTU)	ANNUAL ELECTRIC COST	ANNUAL GAS COST	COMBINED UTILITY COST	ANNUAL UTILITY $/S.F.	ANNUAL KBTU/S.F.	ANNUAL MAINT. COST	COMBINED ANNUAL EXPENSE	COMBINED EXPENSE SAVINGS**	TOTAL LIFE-CYCLE SAVINGS***	SIMPLE PAYBACK (YEARS)****
-	1. Hot water coil heating/DX cooling RTU's with terminal VAV's with hot water reheat coils 2. Standard efficiency cast-iron gas-fired boiler	$3,456,000	626,060	7,050.4	$112,691	$99,142	$211,833	$1.86	80.58	$29,850	$241,683	-	-	-

Option	System	GROSS CAPITAL INVESTMENT*	ANNUAL ELEC. CONS. (KWH)	ANNUAL GAS CONS. (MBTU)	ANNUAL ELECTRIC COST	ANNUAL GAS COST	COMBINED UTILITY COST	ANNUAL UTILITY $/S.F.	ANNUAL KBTU/S.F.	ANNUAL MAINT. COST	COMBINED ANNUAL EXPENSE	COMBINED EXPENSE SAVINGS**	TOTAL LIFE-CYCLE SAVINGS***	SIMPLE PAYBACK (YEARS)****
1	1. Displacement ventilation diffusers and perimeter hot water fintube radiation 2. Gas-fired heating/DX cooling 100% O.A. ventilating units with energy recovery 3. Gas-fired heating/DX cooling 100% O.A. ventilating units with energy recovery with terminal chilled/hot water coil induction units 4. High efficiency gas-fired condensing central boiler plant 5. High efficiency air cooled chiller	$3,104,800	569,430	3,805.2	$102,497	$53,509	$156,006	$1.37	50.42	$23,800	$179,806	$61,877	$1,739,928	N/A******
2	1. Fully air-conditioned displacement ventilation diffusers and perimeter hot water fintube radiation 2. Gas-fired heating/DX cooling 100% O.A. ventilating units with energy recovery 3. Hot water coil heat/chilled water coil cooling 100% O.A. ventilating units with energy recovery with terminal chilled/hot water coil induction units 4. High efficiency gas-fired condensing central boiler plant	$3,628,000	586,480	4,076.8	$105,566	$57,328	$162,894	$1.43	53.31	$26,550	$189,444	$52,239	$1,003,433	4
3	1. Gas-fired heating/DX cooling 100% O.A. ventilating units with energy recovery with terminal chilled/hot water coil induction units 2. Gas-fired heating/DX cooling 100% O.A. ventilating units with energy recovery 3. High efficiency gas-fired condensing central boiler plant 4. High efficiency air cooled chiller	$3,936,600	665,650	3,878.0	$119,817	$54,532	$174,349	$1.53	53.94	$28,775	$203,124	$38,559	$384,000	12

Thank You

Questions and Discussions

Dover High School and Career Technical Center
Dover, NH
J#831 044 00.00
L#47907/Page 1/May 15, 2015

HVAC SYSTEMS NARRATIVE REPORT

OPTIONS 3B & 3D - NEW CONSTRUCTION

The following is the HVAC system narrative, which defines the scope of work and capacities of the HVAC system as well as the Basis of Design. The HVAC systems shall be designed and constructed for ***LEED for Schools*** where indicated on this narrative.

1. CODES:

   All work installed under Division 230000 shall comply with the State of New Hampshire Building Code and all local, IBC 2012, county, and federal codes, laws, statutes, and authorities having jurisdiction.

2. DESIGN INTENT:

   The work of Division 230000 is described within the narrative report. The HVAC project scope of work shall consist of providing new HVAC equipment and systems as described here within. All new work shall consist of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Heating, Ventilating and Air Conditioning work and all items incidental thereto, including commissioning and testing.

3. BASIS OF DESIGN:

   Project weather and Code temperature values are listed herein based on weather data values as determined from ASHRAE weather data tables and the International Energy Conservation Code.

   Outside: Winter -2 deg. F, Summer 88 deg. F DB 73 deg. F WB

   Inside: 70 deg. F +/- 2 deg F for heating, 75 deg. F +/- 2 deg F (55% RH) for cooling for areas with air conditioning, 78 deg. F +/- 2 deg. F (<60% RH) for areas with displacement/dehumidification*(see Displacement Ventilation note below). Unoccupied temperature setback will be provided (60 deg F heating (adj.), 85 deg F cooling/dehumidification (adj.).

   Outside air shall be provided at the rate in accordance with ASHRAE guide 62.1-2010 and the International Mechanical Code as a minimum. All occupied areas will be designed to maintain 800 PPM carbon dioxide maximum.

4. SYSTEM DESCRIPTION:

   A. Central Heating Plants: ***LEED for Schools Credit EP2 & EC1***

      Heating for the entire building will be through the use of a high efficiency gas-fired condensing boiler plant.

      The new boiler plant shall be provided with (4) 2,500 MBH output boilers and (2) end suction base mounted primary and standby pumps with a capacity of 680 gpm each will be located in the mechanical room. Boilers shall each be sized for approximately 33% of the building radiation heating load. In addition to new boilers and pumps, new hot water accessories including air separators and expansion tanks shall be provided.

The boiler plant will supply heating hot water to heating equipment and systems located throughout the building through a two-pipe fiberglass insulated schedule 40 black steel and copper piping system. The boiler plants shall supply a maximum hot water temperature of 160 deg F on a design heating day and the hot water supply water temperature will be adjusted downward based on an outside temperature reset schedule to improve the overall operating efficiency of the power plants. Primary and standby end suction base mounted pumps will be provided with variable frequency drives for variable volume flow through the water distribution system for improved energy efficiency.

Combustion air for each boiler will be directly ducted to each boiler through a galvanized ductwork distribution system. Venting from each boiler shall be through separate double wall aluminized stainless steel (AL29-4C) vent system and shall discharge approximately 12 feet above the roof level. Final venting height will be depending on the location of building intake air locations and adjacent roofs.

B. Central Cooling Plant: ***LEED for Schools Credit EP2 & EC1***

A high efficiency central chilled water cooling plant consisting of a 50 ton high efficiency air cooled chilled, primary and standby chilled water pumps with VFDs, each with a capacity of 110 gpm, accessories, controls and steel and copper piping distribution system shall be provided to serve chilled water cooling HVAC equipment located throughout the building. The chilled water system will consist of a 35% propylene glycol solution. A glycol make-up feed unit system shall be provided.

The chiller plant shall serve active chilled beam induction units located in the Administration, Town Square, Forum areas of the building and select classrooms that require full air conditioning.

C. Classroom Heating and Ventilation *(General Classrooms, Learning Commons, Science, Art, SPED, Cosmetology, Computer Tech/Programming, Life, Health and Family Cons Science)**:***
LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1

It is proposed that new displacement ventilation systems are installed to serve the Building classroom areas under this Option.

New air handling units with supply and return fan with VFDs, energy recovery wheels, gas fired heating and DX cooling with modulating capacity control, sensible reheat wheel or heat pipe, and MERV 13 filtration will be provided to serve the new displacement ventilation system. Supply air will be provided to the space through new insulated, galvanized steel supply duct distribution system and shall be connected to wall mounted displacement ventilation diffusers located within the classrooms. Return air will be drawn back to the units by ceiling return air registers located within the classroom and will be routed back to the air handling unit by an insulated galvanized sheetmetal return air ductwork distribution system. Supplemental hot water fin tube radiation or ceiling radiant heating will be provided along exterior walls.

Each classroom will be provided with a variable air volume terminal box and CO2 sensor for demand ventilation control.

It is estimated that the following air handling equipment will be required to serve these Classroom areas:

RTU-1, 2, 3, 4, 5 & 6: Six (6) rooftop air handling units with a capacity of 12,000 CFM (42.5 tons cooling, 530 MBH heating output) each, to serve the three main classroom wings.

RTU-7: One (1) rooftop air handling unit with a capacity of 4,500 CFM (17.5 tons cooling, 200 MBH heating output) to serve the Business and SPED classrooms.

RTU-8: One (1) rooftop air handling unit with a capacity of 8,000 CFM (30 tons cooling, 350 MBH heating output) to serve the Computer Technology & Programming, Life Science, Health Sciences and Family Cons. Sciences Classroom areas.

Displacement Ventilation:

The displacement ventilation system for the classroom wings are intended to provide a maximum cooling temperature during peak cooling periods of approximately 78°F ± 2°F, however, the ventilation air provided will be extremely dry which will be the result of utilizing refrigeration equipment and hot gas reheat to reduce vapor pressure to an extremely low condition of approximately 50 grains of moisture per pound of air and reheating the air to a supply temperature of approximately 68°F which will be distributed to each space. The extremely dry condition of the supply air provides the perception of a condition that is cooler than is actually occurring due to the evaporation of moisture to the adjacent air from the occupants of the space.

Considering maximum cooling requirements occur primarily during the months of July and August when the majority of the academic areas are not in use, it would suggest maintaining slightly higher temperatures may not present a discomfort, however, will relate to a substantial operating cost savings and a reduced installation cost.

An additional major benefit of utilizing dry air within the building will be the overall reduction of vapor pressure typically present in outside ventilation air during summer months. This reduction in vapor pressure will dramatically reduce the amount of moisture entering the building and the potential of condensation resulting in moisture, and a direct relationship with the formation of mold.

Classrooms Requiring Full Air Conditioning:

Classrooms that require full air conditioning will be provided with supplemental cooling active chilled beam induction units.

D. Gymnasium:
LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1

RTU-9&10: The gymnasium will be served by two (2) air-handling unit of the recirculation design. The unit will be approximately 6,500 CFM and will include supply and return fans with VFDs, 320 MBH output gas-fired heating and 22 Tons DX cooling with modulating capacity control, MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed maintaining a maximum of 800 PPM. Supply air ventilation will be provided to the space through an exposed galvanized steel supply duct with drum louvers to project the air to the floor. As levels of carbon dioxide drop generally relating to a

reduction in population a variable frequency drive located in each air-handling unit will modulate to reduce airflow and ventilation while always maintaining a maximum of 800 ppm. Return air will be drawn back to the air handling unit by a low wall return air register.

E. Alternate PE:
LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1

RTU-11: The Alternate PE area will be served by a rooftop air-handling unit of the recirculation design. The unit will be approximately 2,500 CFM and will include supply and return fans with VFDs, 130 MBH output gas fired heating and 7.5 Ton DX cooling with modulating capacity control, MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed maintaining a maximum of 800 PPM. Supply air ventilation will be provided to the space through an exposed galvanized steel supply duct with drum louvers to project the air to the floor. As levels of carbon dioxide drop generally relating to a reduction in population a variable frequency drive located in each air-handling unit will modulate to reduce airflow and ventilation while always maintaining a maximum of 800 ppm. Return air will be drawn back to the air-handling unit by a low wall return air register.

F. Fitness Room:
LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1

RTU-12: The Fitness area will be served by an rooftop air-handling unit of the recirculation design. The unit will be approximately 2,000 CFM and will include supply and return fans with VFDs, 120 MBH output heating and 6.5 Ton DX cooling with modulating capacity control, MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed maintaining a maximum of 800 PPM. Supply air ventilation will be provided to the space through an exposed galvanized steel supply duct with drum louvers to project the air to the floor. As levels of carbon dioxide drop generally relating to a reduction in population a variable frequency drive located in each air-handling unit will modulate to reduce airflow and ventilation while always maintaining a maximum of 800 ppm. Return air will be drawn back to the air-handling unit by a low wall return air register.

G. Locker Rooms:
LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1

RTU-13 & RTU-14: The Boys and Girls locker rooms, and adjacent PE office areas will be provided with new roof-mounted air handling units of the 100% outside air design with energy recovery. There will be (2) units, with one unit serving the Boy's locker room areas and the other unit serving the Girl's locker room areas. Both units will be approximately 3,200 CFM and will include a supply and exhaust fan with VFDs, 200 MBH output gas fired heating section with modulating capacity control, DX cooling for dehumidification and MERV 13 filtration. Supply air ventilation will be provided to each space through new galvanized supply duct which will travel throughout each locker room area to a series of ceiling mounted supply registers. New exhaust air ductwork and air distribution devices shall be installed and shall be routed from the locker and team rooms to the new air handling units.

H. Auditorium and Stage:
LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1

The auditorium and stage will be provided with new roof-mounted air handling units of the recirculation design capable of providing 100% outside air variable volume displacement ventilation air distribution to the Auditorium and Stage areas.

RTU-15: The Auditorium unit will be approximately 10,000 CFM and will include supply and return fans with VFDs, 480 MBH output gas fired heating section with modulating capacity control, 35 ton DX cooling system and MERV 13 filtration.

RTU-16: The stage unit will be approximately 4,000 CFM and will include supply and return fans with VFD's, 180 MBH gas-fired heating section with modulating capacity control, 10 ton DX cooling system and MERV 13 filtration.

Supply air ventilation to the auditorium will be provided to the space through a galvanized steel supply duct distribution system that will connect to displacement diffusers under the seating. In addition, carbon dioxide controls will be installed which will monitor the overall level of carbon dioxide at a threshold level of 800 ppm. As levels drop generally relating to a reduction in population the air handling unit outside air damper will modulate to reduce air flow and ventilation while always maintaining a maximum of 800 ppm. Return air will be drawn back to the units by return air registers located high on walls within the space or near the ceiling of the space.

I. Music/Chorus/Band/Practice rooms***:***
LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1

It is proposed that new displacement ventilation systems are installed to serve the Music, Chorus, Band and Practice classroom areas under this Option.

A rooftop air handling unit with supply and return fan with VFDs, energy recovery wheels, gas fired heating and DX cooling with modulating capacity control, sensible reheat wheel or heat pipe, and MERV 13 filtration will be provided to serve the new displacement ventilation system. Supply air will be provided to the space through new insulated, galvanized steel supply duct distribution system and shall be connected to wall mounted displacement ventilation diffusers located within the classrooms. Return air will be drawn back to the units by ceiling return air registers located within the classroom and will be routed back to the air handling unit by an insulated galvanized sheetmetal return air ductwork distribution system. Supplemental hot water fin tube radiation or ceiling radiant heating will be provided along exterior walls.

Each classroom will be provided with a variable air volume terminal box and CO2 sensor for demand ventilation control.

It is estimated that the following air handling equipment will be required to serve these Classroom areas:

RTU-17: One (1) rooftop air handling unit with a capacity of 3,500 CFM (15 tons cooling, 200 MBH heating output).

J. Administration Areas (HS, CTC & Marketing):
LEED for Schools Credit EO2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1

Spatial heating and air-conditioning for the HS, CTC Administration area, Marketing and Guidance offices will be served by horizontal ceiling concealed type ducted 4-pipe heating and cooling active chilled beam induction units with hot water and chilled water for the induction unit system provided by the individual hot water and chilled water central recirculation piping system communicating with the boiler and chilled water power plants.

RTU-18: The ventilation rooftop air handling will serve the Administration office areas and the Town Square and Forum areas of the building. The unit capacity will be approximately 12,500 CFM and will include supply and return fan with VFDs, 550 MBH output gas fired heating section with modulating capacity control, MERV 13 filtration, 35 ton capacity DX cooling section, and exhaust air energy recovery wheel. Supply air ventilation will be provided to each space that will satisfy building code requirements based on population.

K. Town Square/Forum:
LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1

Spatial heating and air-conditioning for the Town Square and Forum area will be served by horizontal ceiling concealed type ducted 4-pipe heating and cooling active chilled beam induction units with hot water and chilled water for the induction unit system provided by the individual hot water and chilled water central recirculation piping system communicating with the boiler and chilled water power plants.

RTU-18: Please refer to Administration Area RTU description.

L. Kitchen:
LEED for Schools Credit EP2

The kitchen area shall be provided with new kitchen exhaust air fan and make-up air handling unit with hot water heating. The kitchen will be heated by a heating and ventilation air-handling units with gas fired heating, MUA-1 unit.

A variable volume kitchen exhaust hood control system consisting of kitchen exhaust stack temperature and smoke density sensors, supply and exhaust fan variable speed drives and associated controller will be provided by the kitchen equipment vendor. This system installation shall be field installed and coordinated with the ATC and Electrical contractors.

M. Culinary:
LEED for Schools Credit EP2

The Culinary area shall be provided with new kitchen exhaust air fan and make-up air handling unit with hot water heating. The kitchen will be heated by a heating and ventilation air-handling units with gas-fired heating, MUA-2 unit.

A variable volume kitchen exhaust hood control system consisting of kitchen exhaust stack temperature and smoke density sensors, supply and exhaust fan variable speed drives and associated controller will be provided by the kitchen equipment vendor. This

system installation shall be field installed and coordinated with the ATC and Electrical contractors.

N. Wood Shop:

RTU-19: The wood shop will be provided with a gas fired roof mounted air handling unit of 100% outside air design. The unit will have a capacity of 6,000 CFM with 300 MBH output heating capacity. The unit will include a supply fan, exhaust fan, energy recovery wheel, gas fired furnace with modulating gas valve, MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed and maintaining a maximum of 800 PPM. Supply air ventilation will be provided to the space through an overhead galvanized supply air distribution system. Return air will be delivered back to the rooftop unit via a galvanized return air duct distribution system connected to low wall return air registers. As levels of carbon dioxide drop generally relating to a reduction in population, the rooftop unit's outside air damper will modulate to reduce outside air flow ventilation while always maintaining a maximum of 1000 ppm and room temperature and humidity set points.

Also located within the wood shop will be a fully engineered dust collection system with all associated controls, filters, rotary valves and safety features such as explosion proof motors and fire extinguishing device located within the ductwork. Blast gates will also be provided for each piece of equipment. All ductwork shall be designed for high velocity systems with gasket locked connections. The system shall have a capacity of approximately 6000 cfm. A typical manufacture of this system would be Donaldson Torit, model DFO.

The system shall be equipped with a listed spark detection system locate down the duct upstream of the collector and downstream from the last material entry point. A high speed abort gate activated by the spark detector shall divert any burning material to atmosphere before it can enter the building. The abort gate shall have a manual reset so that after it has aborted, it can be reset to the normal position. A typical manufacture of this system would be GreCon, model RBS-2.

O. Welding Shop / Pre-Engineering:

RTU-20: The Welding shop and Pre-Engineering Shop will be provided with a gas fired roof mounted air handling unit of the 100% outside air design. The unit will have a capacity of 6,000 CFM with 300 MBH output heating capacity. The unit will include a supply fan, exhaust fan, energy recovery wheel, gas fired furnace with modulating gas valve, MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed and maintaining a maximum of 1000 PPM. Supply air ventilation will be provided to the space through an overhead galvanized supply air distribution system. Return air will be delivered back to the rooftop unit via a galvanized return air duct distribution system connected to low wall return air registers. As levels of carbon dioxide drop generally relating to a reduction in population, the rooftop unit's outside air damper will modulate to reduce outside air flow ventilation while always maintaining a maximum of 1000 ppm and room temperature and humidity set points.

Also located within the welding shop will be welding boots which will require the appropriate exhaust systems. Each welding station will be provided with its own separate exhaust drop for individual exhaust air capture. Two exhaust fans at approximately 1500 cfm each.

P. Auto Technology Shop:

RTU-21: The Auto Technology shop will be provided with a gas fired roof mounted air-handling unit of the 100% outside air design. The unit will have a capacity of 3,500 CFM with 200 MBH output heating capacity. The unit will include a supply fan, exhaust fan, energy recovery wheel, gas fired furnace with modulating gas valve, MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed and maintaining a maximum of 1000 PPM. Supply air ventilation will be provided to the space through an overhead galvanized supply air distribution system. Return air will be delivered back to the rooftop unit via a galvanized return air duct distribution system connected to low wall return air registers. As levels of carbon dioxide drop generally relating to a reduction in population, the rooftop unit's outside air damper will modulate to reduce outside air flow ventilation while always maintaining a maximum of 1000 ppm and room temperature and humidity set points.

Also located within the shop will be a fully engineered vehicle capture exhaust system which will be utilized to capture the exhaust fumes of the small engines during start up procedures or demonstrations. The system will have an approximate capacity of 2000 CFM and will consist of explosion proof motors.

Q. Auto Body Collision Shop:

RTU-22: The Auto Body Collision shop will be provided with a gas fired roof mounted air-handling unit of the 100% outside air design. The unit will have a capacity of 8,000 CFM with 400 MBH output of heating capacity. The unit will include a supply fan, exhaust fan, energy recovery wheel, gas fired furnace with modulating gas valve, MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed and maintaining a maximum of 1000 PPM. Supply air ventilation will be provided to the space through an overhead galvanized supply air distribution system. Return air will be delivered back to the rooftop unit via a galvanized return air duct distribution system connected to low wall return air registers. As levels of carbon dioxide drop generally relating to a reduction in population, the rooftop unit's outside air damper will modulate to reduce outside air flow ventilation while always maintaining a maximum of 1000 ppm and room temperature and humidity set points.

Also located within the shop will be a fully engineered vehicle capture exhaust system which will be utilized to capture the exhaust fumes of the engines during start up procedures or demonstrations. The system will have an approximate capacity of 5000 CFM and will consist of explosion proof motors.

A paint booth will also be located within the shop area and will be provided with a packaged exhaust system with explosion proof motors sized at an approximate capacity of 12,000 cfm. To maintain neutral pressure within the space once the exhaust systems are activated the paint booth will be provided with its own dedicated make up air unit, MAU-3, to maintain a neutral pressure within the paint booth. The paint booth will operate as its own independent system rather than interlocking it with the shops air handling unit. This will prevent oversizing of the shops unit and consume less energy.

R. Building Technology Shop:

RTU-23: The Building Technology shop will be provided with a gas fired roof mounted air handling unit of 100% outside air design. The unit will have a capacity of 6,000 CFM with

300 MBH output of heating capacity. The unit will include a supply fan, exhaust fan, energy recovery wheel, gas fired furnace with modulating gas valve, MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed and maintaining a maximum of 800 PPM. Supply air ventilation will be provided to the space through an overhead galvanized supply air distribution system. Return air will be delivered back to the rooftop unit via a galvanized return air duct distribution system connected to low wall return air registers. As levels of carbon dioxide drop generally relating to a reduction in population, the rooftop unit's outside air damper will modulate to reduce outside air flow ventilation while always maintaining a maximum of 1000 ppm and room temperature and humidity set points.

Also located within the wood shop will be a fully engineered dust collection system with all associated controls, filters, rotary valves and safety features such as explosion proof motors and fire extinguishing device located within the ductwork. Blast gates will also be provided for each piece of equipment. All ductwork shall be designed for high velocity systems with gasket locked connections. The system shall have a capacity of approximately 4000 cfm. A typical manufacture of this system would be Donaldson Torit, model DFO.

The system shall be equipped with a listed spark detection system locate down the duct upstream of the collector and downstream from the last material entry point. A high speed abort gate activated by the spark detector shall divert any burning material to atmosphere before it can enter the building. The abort gate shall have a manual reset so that after it has aborted, it can be reset to the normal position. A typical manufacture of this system would be GreCon, model RBS-2.

S. Electrical Shop:

RTU-24: The Building Technology shop will be provided with a gas fired roof mounted air handling unit of 100% outside air design. The unit will have a capacity of 6,200 CFM with 300 MBH of heating capacity. The unit will include a supply fan, exhaust fan, energy recovery wheel, gas fired furnace with modulating gas valve, MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed and maintaining a maximum of 800 PPM. Supply air ventilation will be provided to the space through an overhead galvanized supply air distribution system. Return air will be delivered back to the rooftop unit via a galvanized return air duct distribution system connected to low wall return air registers. As levels of carbon dioxide drop generally relating to a reduction in population, the rooftop unit's outside air damper will modulate to reduce outside air flow ventilation while always maintaining a maximum of 1000 ppm and room temperature and humidity set points.

T. Lobby, Corridor, and Entry Way Heating:

New hot water convectors, cabinet unit heaters and fin tube radiation heating equipment shall be installed to provide heating to these areas. Corridors shall be ventilated from adjacent air handling unit systems.

U. Custodial Support Areas:

HVU-1: Custodial support areas will be heated and ventilated by a heating and ventilation unit with an estimated capacity of 1,800 CFM. Storage areas will be heated by

radiation heating equipment. Horizontal type unit heaters will heat areas adjacent to the loading dock. All custodial closets will be exhausted by exhaust air fan systems.

V. Utility Areas:

Utility areas will be provided with exhaust air fan systems for ventilation, and will typically be heated with horizontal type ceiling suspended unit heaters.

The main IDF room will be air conditioned by high efficiency ductless AC cooling units.

W. Testing, Adjusting, Balancing & Commissioning:

All new HVAC systems shall be tested, adjusted, balanced and commissioned as part of the project scope.

X. Automatic Temperature Controls – Building Energy Management System

A new DDC (direct digital control) automatic temperature control and building energy management system shall be installed to control and monitor building HVAC systems. Energy metering shall be installed to monitor the energy usage of building HVAC systems and utilities (fuel, gas, water).

The control system shall be as manufactured by Johnson Controls, Honeywell, Siemens or Equal.

5. TESTING REQUIREMENTS:

A. The mechanical contractor shall provide testing of the following systems with the owner and owner's representative present:

1. Boiler plant system

2. Chilled water plant system

3. Air handling unit systems including all rooftop units, indoor air handling systems and exhaust air systems

4. Terminal heating and cooling devices

5. Automatic temperature control and building energy management system

B. Testing reports shall be submitted to the engineer for review and approval before providing to the owner.

6. OPERATION MANUALS AND MAINTENANCE MANUALS: When the project is completed, the mechanical contractor shall provide operation and maintenance manuals to the owner.

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7. RECORD DRAWINGS AND CONTROL DOCUMENTS: When the project is completed, an as-built set of drawings, showing all mechanical system requirements from contract and addendum items will be provided to the owner.

8. COMMISSIONING: The project shall be commissioned per Section 018000 of the specifications.