nationalgrid

Technical Assistance Study

Retrofit

Prepared for

RI State – Department of Labor & Training, Pastore Campus

Prepared by

Demand Management Institute

300 Chestnut Street

Needham, MA

August 2, 2019

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Acknowledgements

The cooperation and assistance of Department of Labor and Training, Pastore Campus is greatly appreciated in making this study possible. This report is the work of Erica Anderson and Jay Robbins; please feel free to contact DMI with any questions or comments.

Project Team

Department of Labor and Training			
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Project Description

DMI has been retained by National Grid to investigate the energy savings associated with a retrofit project at the ~153,026 ft^2 DLT facility on the Pastore Campus in Cranston, RI. This facility consists of 6 buildings that are interconnected, #68-#73.

The measure in this project considers energy savings from enabling unoccupied mode on 25 existing RTUs and AHUs. Unoccupied mode controls would allow the OA dampers to close completely and to cycle the AHU supply and return fans to maintain space set points. Savings results from reduced heating and cooling ventilation loads along with reduced fan power.

The air-side equipment is approximately 20 years old. Facility personnel has no current plans to replace the AHUs and RTUs and expects they will remain in place for a minimum of 5 years, ideally longer.

There are multiple options for implementing this project. The low cost option is to repair dampers as necessary to allow the dampers to modulate closed. This would resolve the issue of being unable to maintain space temperature setpoints and unoccupied schedules could be implemented, allowing for cycling of fan motors. An alternative solution would be to perform an early replacement of the AHUs, which would also allow for unoccupied mode to be enabled.

Table 1 below shows a summary of the measure savings, including energy savings, payback, and incentive eligibility. The default electric rate of $0.20/kWh was used.

Table 1: ECM Summary

ECM	Measure	Program	Savings			% On	Demand Red (kW)		Cost	Payback	Incentive
No.	Description	Path	kWh	Therms	$	Peak	Summer	Winter	$	years	$
1	Investigate unoccupied airflow controls	Custom	433,347	31,076	$117,124	21%	0	23.8	$300,000	2.56	TBD

Existing Case

The 25 AHUs are constant volume units overridden by the building operator to maintain a space temperature of 72-74°F set on the EMS 24/7. There are currently no unoccupied mode setbacks, as there are a limited number of zone heating elements and the system has difficulty bringing spaces back to temperature. Furthermore, the outdoor air dampers remain open, at least at the minimum position, during unoccupied hours. Operational hours of the facility are 7AM – 6 PM on non-holiday weekdays 24/7 on weekends.

Proposed Case

The proposed case considers savings associated with implementing controls to both close the OA dampers completely during unoccupied periods and to cycle the AHU supply and return fans to maintain space setpoints. As described above, there are multiple methods of enabling this unoccupied mode control.

Energy Savings Methodology

Energy savings were modeled in a temperature-dependent bin model using TMY3 weather data for Providence, RI. The energy model includes the savings associated with the reduction in fan power during unoccupied hours. Additionally, there are also savings from reduced heating and cooling loads in the form of reduced steam usage from the Pastore Campus power plant.

Existing Case Verification – Outside Air Dampers

Savings for this project are contingent on the report that all of the AHUs serving the facility operate 24/7, but there is no trending capability at the site to verify the existing operation. DMI collected meter data for damper position and fan run time for a sample of 6x AHUs for a 2 week metering period. One AHU was sampled in each of the six buildings that make up the facility. The metered data included 6 tilt loggers on the outside air dampers of each unit, as well as state loggers on each supply fan motor.

Analysis of the tilt logger data shows only 4 of the loggers provided reliable data, so DMI conducted the analysis based on remaining 4 tilt loggers. Unit 71-4 was closed at the time of the tilt logger launch and remained closed for the entire duration of the metering period. The other three units maintained open or at least a minimal position, including overnight hours. The fans associated with these open units run constantly at their rated speed.

Below is the graph for AHU 70-1 in building 70.

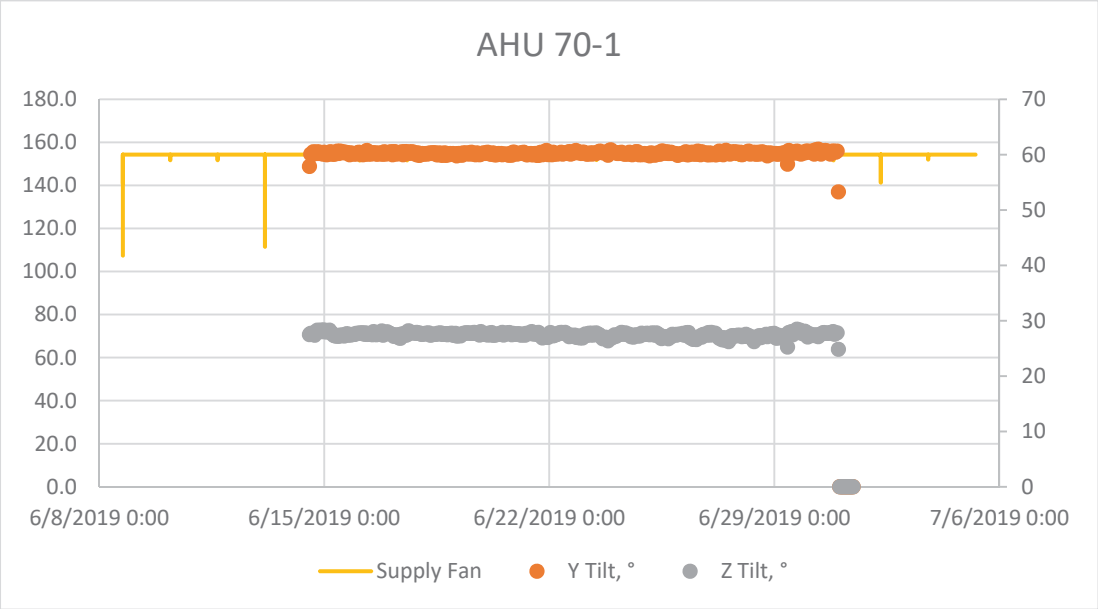

Figure 1

The metered data using tilt loggers represent the degree value from all three axis. The data of Y and Z axis determines the position of a given damper. X axis remains constant. The vertical position of tilt logger facing towards observer states close position of damper. The graph of AHU 70-1 explains that Y axis was at 150° constantly which can be comprehend in manner that the

damper was partially open during metering time. The unreliable data has movement in X-axis which can't decide the movement of damper whether the damper is open or close.

DMI has used the minimum outside air CFM from each RTU/AHU and sum it as a one RTU/AHU outside air CFM within the energy model. The finding that 3 of 4 or 75% of AHUs have an outside air damper open 24/7 was applied to the existing total outside air in the energy model. DMI calculated the existing case energy usage during unoccupied hours, which is approximately 6,000 hours per year. The proposed case has zero outside air CFM during unoccupied periods and there are no unoccupied heating and cooling loads for treating outside air.

Proposed

The 6 state loggers that DMI installed confirmed 24/7 operation of AHU fans, including the AHUs in which the tilt loggers provided unreliable data or that the OA dampers are closed 24/7. The existing case reflects 24/7 operation of all 25 AHU fans. The fan motors were not metered and input kW is based on the assumption of 70% motor load and 93% motor efficiency.

For fan savings, DMI estimated the percent of time the fan operates during unoccupied hours through setback temperatures which is 80 and 65°F for cooling and heating, respectively. It is estimated that fan starts at 80°F for cooling season and operates at 80% load at 100°F. Similarly during heating season, fan starts at 65°F and operates at 100% load during 0°F. This assumption results in a 72% decrease in unoccupied mode fan operating hours.

The savings from steam is converted into therms savings assuming steam plant efficiency at 75% (Including distribution losses). Cooling system is performed by the absorption chiller 'Trane ABSC-256' using steam from central plant and chiller has a performance of 19.77 lb/ton/hr.

Summary

Per an interview with the facility manager, it is determined that the measure life of this project is 7 years.

The estimate of the project cost is $300,000; this results in an estimated payback period before incentive of 2.56 years, though this measure will qualify for an incentive from National Grid. DMI reviewed the CHP plant data from the facility which was obtained during 2016 scoping study. The facility was importing 1.4 MWh and 2.8 MWh in 2015 and 2016 respectively which is 5.8% of total energy consumption. The savings 433,347 kWh from fan power will reduce electricity importing from the grid.

Appendix

A. Original TA Study Proposal

B. Screening Tool Output Pages

C. Minimum Requirements Document

D. Equipment Submittal

Appendix A: TA Study Proposal

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June 5, 2019

Andrea Moshier
Supervisor, EE Technical Services
National Grid
280 Melrose Street
Providence RI 02907

RE: RI State – Department of Labor & Training, Pastore Campus TA Study Proposal

Dear Andrea,

DMI previously performed a scoping study in the February of 2017 for the DLT building at the Pastore Campus, 1511 Pontiac Ave in Cranston, RI. In this study, many energy conservation measures (ECMs) were identified, including ECM 9: Investigate Unoccupied Airflow Controls (Custom Retrofit). This TA study will investigate this measure, which will now be referred to as ECM1. The building is currently served by 25 air handling units (AHUs) that do not have unoccupied setback controls. DMI proposes to collect meter data and EMS screenshots to document existing unoccupied mode operation for the AHUs and estimate energy savings for the proposed scope of work.

Facility Description

The DLT is a complex of six interconnected buildings (#68-73) totaling 153,026 ft^2. All building spaces were renovated in 1998 and new mechanical systems were installed. These buildings are similar in design and operation; a majority of the spaces are offices. Building hours are ~7AM to 6PM on weekdays. The facility receives electricity and steam produced at the campus power plant. There is a central heating system and cooling system located in the basement of building 73 (the newest building).

There are between two and four air handling units that provide space conditioning in each building, resulting in a total of 25 AHUs between the six buildings. These constant volume AHUs have chilled water-cooling coils, hot water heating coils, and economizer controls. The AHUs are zoned by quadrant such that, within a building, generally all AHUs serve each floor. Each AHU is controlled by one thermostat located on the middle floor. Given that temperature is controlled according to the middle floor space conditions, there are space comfort complaints on the top and bottom floors. Also, as AHUs serve adjacent spaces on the same floor, the AHUs may operate in conflicting modes (i.e. one in cooling and one in heating). Furthermore, many buildings have one return duct per floor which provides the return for multiple AHUs. This results in draft issues. These AHUs are controlled by the building operator via the EMS; space temperature is maintained between 72-75°F. There is minimal zone heating in the building, so the site does not operate the AHUs with nighttime setbacks as there are concerns with the bringing the buildings back to temperature.

Energy Conservation Measures

ECM 1: Investigate Unoccupied Airflow Controls (Custom Retrofit)

The 25 AHUs are controlled to maintain a space temperature of 72-74°F set by the building operator on the EMS. There are currently no unoccupied mode setbacks, as there are a limited number of zone

heating elements and the system has difficulty bringing spaces back to temperature. Furthermore, the outdoor air dampers remain open, at least at minimum position, during overnight hours. This measure suggests investigating the unoccupied mode controls and implementing controls to both close the OA dampers completely during unoccupied periods and to cycle the AHU supply and return fans to maintain space setpoints. The solution could be as simple as installing new controllers; however, replacing the entire units may be a more cost-effective long-term solution. Savings may result from reduced heating and cooling ventilation loads along with reduced fan power.

Additionally, space temperature setbacks could be implemented to save heating energy in the winter and cooling energy in the summer. If setbacks are not possible as some spaces have difficulty being brought back to temperature, the systems may need to be rebalanced. Additional investigation is required.

All 25 AHUs were installed in 1998 and are now 21 years old. They are approaching end of useful life, but they are still functioning and the facility operator expects that most will continue to operate for at least another ~7 years.

Scope of Work and Fee

DMI will visit the site to collect EMS screenshots for as many AHUs as available and install meters to verify 24/7 runtime and outside air damper position during unoccupied periods. The existing EMS does not have trending capability to demonstrate this operation. DMI will then use the data to develop and verify the energy model, and modify it as needed to assist in optimizing payback periods. The report will include a minimum requirements document, screening tool output, and all data required for a National Grid TA study. DMI will review the most recent year of Pastore campus CHP operation data to determine the breakdown of electric and gas savings.

Our fee to provide the scope of work described herein is $10,380. Jay Robbins will oversee the project, and Erica Anderson will perform the analysis and provide documentation. DMI plans to release a draft report summarizing our modeling results within three weeks of approval to proceed, following two weeks of data collection.

If this proposal is acceptable, please issue an ESR. Please feel free to call with any questions or comments.

It is a pleasure to be of service to you and your customer.

Sincerely,

Erica Anderson
Project Engineer
DMI
(781) 449-5700 x21

Appendix B: Screening Tool Output Pages

Project Description and Contact Information (click box to left to show/hide)

Project Description	Install new controls for dampers to close during unoccupied hours
Existing or Base Case Condition Description	Existing damper open position without no controls during occupied/unoccupied mode
Proposed Description	Install new controls equipments to modulate the damper position based on occupancy schedule
Project Screened by	
Project Screened on	

	Customer	Electric PA	Gas PA
Company Name	Department of Labor and Training	National Grid Electric - RI	National Grid Gas - RI
Contact Name	Amaral Carlton	Andrea Moshier	Andrea Moshier
Contact Email	Carlton.Amaral@doa.ri.gov	Andrea.Moshier@nationalgrid.com	Andrea.Moshier@nationalgrid.com
Contact Phone Number	(401) 462-8203	(401) 784-7414	(401) 784-7415
Account #(s)			
Application #			
TA Vendor			

Retail Rates and Screening Messages (click box to left to show/hide)

Retail Rates

Electric Rate ($/kWh)	$0.20
Gas Rate ($/therm)	$0.98
Oil Rate ($/MMBtu)	
Propane Rate ($/MMBtu)	
Water Rate ($/gal)	

Error Messages for Included Measures (displayed errors are active):

Screening Message for Included Measures (displayed messages are active):

Measure and Result Overview (click box to left to show/hide)

	ECM 1	ECM 2	ECM 3	ECM 4	ECM 5	ECM 6	ECM 7	ECM 8	ECM 9	ECM 10	Selected Measures Project	All Measures Project
Measure Code	HVAC_control											
Dual Baseline Applicable?	0	0	0	0	0	0	0	0	0	0		
Measure Life for Tracking	7	0	0	0	0	0	0	0	0	0		
BCR	2.99	-	-			-	-				2.99	2.99
Total Payback	2.59	-	-	-	-	-	-	-	-	-	2.59	2.59
% Electric Allocation	60%	0%	0%	0%	0%	0%	0%	0%	0%	0%	60%	60%
% Gas Allocation	40%	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%	40%
Adjusted Total/Incremental Cost	$300,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$300,000	$300,000

Measure Inputs - First Year Savings

		ECM 1	ECM 2	ECM 3	ECM 4	ECM 5	ECM 6	ECM 7	ECM 8	ECM 9	ECM 10		
Measure Information	Measure Label												
	Include in project	1										1 ECMs Included	1 ECMs Total
	Initiative	Existing Building Retrofit											
	Fuel Savings Type	Dual											
	Measure	EMS / controls, HVAC											
	Estimated Useful Life (Years)	10											
	Override Life (Optional)	7											
Measure Costs	Proposed Cost ($)	$300,000										$300,000	$300,000
	Baseline Cost ($)	$0										$0	$0
Gross Electric Energy (Savings and Penalties)	Energy (kWh)	433,347										433,347	433,347
	% Summer On Peak	9%											
	% Summer Off Peak	34%											
	% Winter On Peak	12%											
	% Winter Off Peak	45%											
Gross Electric Capacity (Savings and Penalties)	Summer Peak kW	-										-	-
	Winter Peak kW	23.80										23.80	23.80
Gross Natural Gas (Savings and Penalties)	Heating Season (Therms)											-	-
	Year Round (Therms)	31,076										31,076	31,076
	Other (Therms)											-	-
Gross Non-Electric Non-Gas (Savings and Penalties)	#2 Oil (MMbtu)											-	-
	Propane (MMbtu)											-	-
	Water (Gallons)											-	-
	Sewer (Gallons)											-	-
	Annual $											$0	$0
	One Time $											$0	$0

Appendix C: Minimum Requirements Document

Minimum Requirements Document

Customer	**State of RI**	Program	**Retrofit**
Facility	**RI State – Department of Labor & Training, Pastore Campus, Cranston, RI 02920**	Application #:	
Measure	**ECM1: Investigate Unoccupied Airflow Controls**		

This document specifies the agreed upon minimum equipment specifications and operational requirements of the proposed system. These requirements shall address the criteria necessary to be met to achieve the demand and energy savings estimated in the engineering analysis for this project. Yes/No checkboxes are intended for use as National Grid's post-installation inspection record (check one).

EQUIPMENT: *Provide a list of equipment or materials installed as part of this project. Include equipment counts, HP, kW, efficiency and capacity ratings, rating conditions, location of controls hardware, etc.*

	Project Design Intent	Post Inspection Findings
Yes ❑ No ❑	1. Repair or replace outside air dampers and controls so that unoccupied mode can be restored in 19 or more of the facility's 25 air handling units. The dampers should be able to modulate fully closed with the fans cycling to maintain setback space temperature setpoints.	

SEQUENCES OF OPERATION: *Provide a description of equipment operating sequences, setpoints, operating schedules, balancing requirements (flow, velocity, head, etc) or any other required operating parameters. Describe requirements separately.*

Yes ❑ No ❑	2. The outside air dampers will open only during occupied hours, non-holiday weekdays 7AM-6PM. During unoccupied hours, the AHU/RTU damper will close and recirculate air.	
Yes ❑ No ❑	3. Supply and return fans shall cycle to maintain setback space temperature setpoints during unoccupied hours.	

DOCUMENTATION: *List written documentation required to train, verify, operate, or maintain the equipment being installed or controlled. This may include specification sheets, test reports, construction drawings, etc.*

Yes ❑ No ❑	4. Provide documentation (invoices, etc.) of all material, labor, and engineering costs as applicable to document the total installed project costs.	*Not needed at post inspection, but needed for incentive application*
Yes ❑ No ❑	5. Two weeks of 15-minute trend data for outside air CFM, dehumidification temperature, and mixed and supply air temperature.	

POST INSTALLATION VERIFICATION: *Provide a list of controls and monitoring capabilities required to verify proper system operation. Trends should document operational sequences, set points and scheduling of equipment as described in TA Study.*

Yes ❑ No ❑	6. Provide safe access for National Grid to perform post inspection	
Yes ❑ No ❑	7. Provide	

OTHER REQUIREMENTS: *Describe any requirements for demolition, removal, etc. of existing equipment.*

Yes ❑ No ❑	8. None	

The pre-approved incentive is subject to National Grid's POST INSPECTION of final specifications, drawings and operation of the proposed equipment. In the event the proposed system is altered from the above description, notify the Company of the change prior to the equipment purchase and installation as the change in design and operation may impact the available incentive

Minimum Requirements Document

The National Grid signature below indicates the National Grid engineer, or their representative, has reviewed and agrees to the requirements stated in this MRD. The customer signature below indicates the customer also agrees with the requirements of this MRD and will implement as stated. The customer should only sign below if this MRD has been signed by National Grid or its representative.

National Grid Engineer or Representative	Date	Customer Agreement Signature	Date

Once the installation is complete and the equipment is operational, the post inspector will sign below, confirming all requirements of this MRD have been met, and/or any discrepancies have been noted. National Grid will review any discrepancies to determine their impact on energy savings or incentive. The final customer signature indicates that they agree with the findings of the post inspector, including any discrepancies noted, and are satisfied with the installation.

National Grid Post Inspector	Date	Customer Certification of Installation	Date

Appendix D: Equipment Submittal

AIR HANDLING UNITS (ROOF MOUNTED - (4 PIPE)

MARK	SERV/LOCATION	AIR CAPACITY TOTAL CFM	AIR CAPACITY MIN. OA CFM	AIR CAPACITY ESP in WG	AIR CAPACITY TSP in WG	MIN.COIL AREA FT.SQ	MAX. OUTLET VEL.	COOLING CAPACITY EAT DB/WB	COOLING CAPACITY LAT DB/WB	COOLING CAPACITY TOTAL MBH	COOLING CAPACITY SENS. MBH	COOLING CAPACITY FLOW GPM	HEATING CAPACITY EAT/LAT DB/DB	HEATING CAPACITY TOTAL MBH	HEATING CAPACITY FLOW GPM	ELECTRICAL FAN HP. SUPPLY	ELECTRICAL FAN HP. EXH.	ELECTRICAL V / ø	OP. WT. #	MODEL	NOTE(S)
RTU 70-1	BLDG. 70 / ROOF	12780	1400	1.6	3.4	24.4	2500	76/64	55/53	420	295.2	70	67/90	325	26	15	5	480/3	7000	#25T	1,2
RTU 70-2	BLDG. 70 / ROOF	12500	1400	1.6	3.4	24.4	2500	76/64	55/53	411	288.8	70	67/90	320	26	15	5	480/3	7000	#25T	1,2
RTU 70-3	BLDG. 70 / ROOF	4300	650	.8	2.8	7.5	2100	77/65	55/53	126	99.5	21	65/95	143	10	5	2	480/3	4000	#8T	1
RTU 70-4	BLDG. 70 / ROOF	3980	650	.8	2.8	7.5	2100	77/65	55/53	122	96.3	21	65/95	133	10	5	2	480/3	4000	#8T	1
RTU 73-1	BLDG 73 / ROOF	10900	1600	.7	2.5	20.8	2100	77/65	55/53	400	265	68	65/90	300	25	10	5	480/3	7000	#21T	1
RTU 73-2	BLDG 73 / ROOF	7860	800	.7	2.5	14.2	2250	76/64	55/53	260	195	45	70/90	175	15	7.5	3	480/3	5500	#14T	1
RTU 73-3	BLDG 73 / ROOF	10300	1800	1.3	3.3	20.8	2100	77/65	55/53	380	250	65	65/90	295	25	10	5	480/3	7000	#21T	1,2

1. BASED ON TRANE - T SERIES
2. PROVIDE INLET VANES FOR VAV APPLICATION

AIR HANDLING UNITS (4 PIPE)

MARK	SERV/LOCATION	AIR CAPACITY TOTAL CFM	AIR CAPACITY MIN. OA CFM	AIR CAPACITY SUP. FAN ESP	AIR CAPACITY SUP. FAN TSP	AIR CAPACITY RET. FAN ESP	AIR CAPACITY RET. FAN TSP	MIN.COIL AREA FT.SQ	COOLING CAPACITY EAT DB/WB	COOLING CAPACITY LAT DB/WB	COOLING CAPACITY TOTAL MBH	COOLING CAPACITY SENS. MBH	COOLING CAPACITY FLOW GPM	COOLING CAPACITY MAX. Δ Pw	PREHEAT CAPACITY EAT/LAT DB/DB	PREHEAT CAPACITY TOTAL MBH	PREHEAT CAPACITY FLOW GPM	PREHEAT CAPACITY MAX. Δ Pw	HEATING CAPACITY EAT/LAT DB/DB	HEATING CAPACITY TOTAL MBH	HEATING CAPACITY FLOW GPM	HEATING CAPACITY MAX. Δ Pw	ELECTRICAL FAN HP. SUPPLY	ELECTRICAL FAN HP. RET.	ELECTRICAL V / ø	OP. WT. #	MODEL	NOTE(S)
AHU 69A-1	BLDG 69A ATTIC	6545	650	.3	1.5	.35	.35	12.3	76/64	55/54	148	152	25	-	-	-	-	-	68/90	159	15	-	5	2	480/3	2200	#12A	1,4
AHU 69A-2	BLDG 69A ATTIC	6830	680	.3	1.5	.4	.4	12.3	76/64	55/54	206	159	28	-	-	-	-	-	68/90	166	15	-	5	2	480/3	2200	#12A	1,4
AHU 69-1	BLDG 69 ATTIC	7640	770	.5	1.5	.4	.4	14.2	76/64	55/54	230	197	40	-	-	-	-	-	68/90	185	15	-	5	2	480/3	2400	#14A	1,4
AHU 69-2	BLDG 69 ATTIC	4020	400	.4	1.5	.3	.3	7.5	76/64	55/54	121	93	20	-	-	-	-	-	68/90	98	8	-	2	1	480/3	1600	#8A	1,4
AHU 69-3	BLDG 69 ATTIC	5410	550	.4	1.0	.3	.3	12.3	76/64	55/54	163	125	28	-	-	-	-	-	68/90	131	11	-	2	1 1/2	480/3	2200	#12A	1,4
AHU 69-4	BLDG 69 ATTIC	5450	550	.4	1.0	.4	.4	12.3	76/64	55/54	165	126	28	-	-	-	-	-	68/90	132	11	-	2	1 1/2	480/3	2200	#12A	1,4
AHU 69-5	WEST MECH. RM/GRND FLR	2975	300	.5	1.75	.5	.5	5.9	76/64	55/54	90	74	15	-	-	-	-	-	68/90	72	6	-	2	3/4	480/3	1020	#6A	1,4
AHU 69-6	EAST MECH. RM/GRND FLR	1015	300	.5	1.5	-	-	2.8	78/65	55/54	34	26	7	-	-	-	-	-	55/90	40	3.5	-	3/4	-	480/3	225	BCHA 36	1,3
AHU 71-1	BLDG 71 ATTIC	6120	620	.5	1.5	.5	.5	12.3	76/64	55/54	185	142	31	-	-	-	-	-	68/90	148	12	-	5	3	480/3	2200	#12A	1,4
AHU 71-2	BLDG 71 ATTIC	9835	1000	.5	1.5	.5	.5	20.8	76/64	55/54	297	228	50	-	-	-	-	-	68/90	240	20	-	5	3	480/3	3000	#21A	1,4
AHU 71-3	BLDG 71 ATTIC	6800	680	.5	1.5	.5	.5	12.3	76/64	55/54	206	157	35	-	-	-	-	-	68/90	165	15	-	5	3	480/3	2200	#12A	1,4
AHU 71-4	BLDG 71 ATTIC	8675	870	.5	1.5	.5	.5	16.8	76/64	55/54	260	198	45	-	-	-	-	-	68/90	210	17	-	5	5	480/3	2900	#17A	1,4
AHU 72-1	BLDG 72 GROUND	940	940	.6	1.5	-	-	2.8	86/74	55/54	60	36	10	-	-	-	-	-	0/70	80	3	-	.75	-	480/3	225	BCHA 36	1,3
AHU 72-2	BLDG 72 GROUND	830	415	.5	1.5	-	-	1.8	80/70	60/59	32	18	8	-	-	-	-	-	40/75	32	1.5	-	.75	-	480/3	200	BCHA 24	1,3
AHU 72-3	BLDG 72 GROUND	1200	600	.5	1.5	-	-	2.8	80/70	60/59	45	26	9	-	-	-	-	-	40/75	46.2	2.5	-	.75	-	480/3	225	BCHA 36	1,3
AHU 72-4	WEST FACE ATTIC	2755	275	.5	1.75	.5	.5	5.9	76/64	55/54	84	70	14	-	-	-	-	-	68/90	67	5.5	-	2	1.5	480/3	1300	#6A	1,4
AHU 72-5	EAST FACE ATTIC	3120	310	.5	1.75	.5	.5	5.9	76/64	55/54	95	78	16	-	-	-	-	-	68/90	76	6.5	-	2	1.5	480/3	1300	#6A	1,4
AHU 73-1	CAFETERIA / M.E.R.	7200	2600	.6	1.5	-	-	14.2	80/67	53/52	360	215	60	-	-	-	-	-	50/90	32	25	-	5	-	480/3	2500	#14	1
AHU 73-2	KITCHEN MUA	1400	1500	.5	2.0	-	-	3.3	90/76	55/54	145	58	20	-	5/35	49.5	55#/HR	-	35/80	75	6	-	1	-	480/3	2500	#3A	1,2

1. BASED ON TRANE @45°F EVT (CLG) 180°F EWT (HTG).
2. PROVIDE STEAM PREHEAT COIL. HEATING CAPACITY BASED ON 20 PSIG STEAM.
3. HV AUX COIL FOR 4 PIPE OPS.
4. PROVIDE ECONOMIZER AND RETURN AIR FAN SECTION.

FAN COILS (4 PIPE)

MARK	SERVICE/LOCATION	CFM	OA	ESP	COOLING MBH TOTAL	COOLING MBH SENS	GPM	MAX. Pw	HEATING MBH	GPM	MAX. Pw	WATTS	ELEC V / ø	OPER. WT. #	TYPE	MODEL	NOTE(S)
HFC 69A-1	ENTRY STAIR	350	-	-	11.2	7.9	2.3	9.0	33.5	2.3	7.4	100	120/1	115	HOR CAB	D 040	1
VFC 69A-2	STAIR, 2ND FLR	320	-	-	10.2	7.4	2.2	8.2	31.2	2.2	6.8	100	120/1	115	VERT CAB	B 040	1
VFC 69/69A-1	69/69A CONN.	260	-	-	7.2	5.3	1.5	3.7	23.9	1.5	3.0	85	120/1	80	VERT CAB	B 030	1
HFC 69/69A-2	69/69A CONN.	290	-	-	7.6	5.7	1.6	4.0	25.9	1.6	3.3	85	120/1	60	HOR CAB	D 030	1
VFC 69/69A-3	69/69A CONN.	260	-	-	7.2	5.3	1.5	3.7	23.9	1.5	3.0	85	120/1	80	VERT CAB	B 030	1
HFC 69/69A-4	69/69A CONN.	450	-	.25	10.8	9.6	3.3	4.6	51.6	3.3	4.1	125	120/1	80	HOR RESC	E 040	1
HFC 69/69A-5	69/69A CONN.	450	-	.25	10.8	9.6	3.3	4.6	51.6	3.3	4.1	125	120/1	80	HOR RESC	E 040	1
VFC 69-1	STAIR, GRND FLR-WEST	320	-	-	10.6	7.4	2.2	8.2	31.2	2.2	6.8	100	120/1	115	VERT. CAB	B 040	1
VFC 69-2	STAIR, 2ND FLR-WEST	320	-	-	10.6	7.4	2.2	8.2	31.2	2.2	6.8	100	120/1	115	VERT. CAB	B 040	1
VFC 70-1	ENTRY VEST. / BLDG 70	320	-	-	10.6	7.9	2.3	9.0	31.2	2.3	6.8	100	120/1	115	VERT REC	H 040	1
VFC 70-2	ELEV. LOBBY / BLDG 70	190	-	-	4.7	3.8	1.0	6.0	14.7	1.0	3.7	85	120/1	60	VERT REC	H 020	1
VFC 70-3	OFFICE AREA / BLDG 70	320	40	-	10.0	7.9	2.3	9.0	31.2	2.3	6.8	100	120/1	115	VERT CAB	B 040	1
VFC 70-4	BREAK ROOM / BLDG 70	520	150	-	13.4	7.9	2.3	9.0	39.8	2.8	9.3	125	120/1	130	VERT CAB	B 060	1
VFC 70-5	TOILETS / BLDG 70	190	50	-	4.7	3.8	1.0	6.0	14.7	1.0	3.7	85	120/1	60	VERT CAB	B 020	1
VFC 70-6	STAIR / BLDG 70	190	-	-	4.7	3.8	1.0	6.0	14.7	1.0	3.7	85	120/1	60	VERT CAB	B 020	1
VFC 70-7	FOYER STAIR / BLDG 70	320	-	-	10.6	7.4	2.3	9.0	31.2	2.3	6.8	100	120/1	115	VERT CAB	B 040	1
VFC 71-1	STAIR, 1ST FLR	320	-	-	10.6	7.4	2.3	9.0	31.2	2.3	6.8	100	120/1	115	VERT CAB	B 040	1
VFC 71-2	STAIR, 3RD FLR	320	-	-	10.6	7.4	2.3	9.0	31.2	2.3	6.8	100	120/1	115	VERT CAB	B 040	1
VFC 72-1	WORK OUT-GROUND	260	-	-	7.2	5.3	1.5	3.7	25.9	1.5	3.0	85	120/1	85	VERT CAB	B 030	1
VFC 72-2	CORRIDOR-GROUND	260	-	-	7.2	5.3	1.6	3.7	25.9	1.5	3.0	85	120/1	85	VERT CAB	B 030	1
VFC 72-3	VARIOUS	260	-	-	7.2	5.3	1.5	3.7	25.9	1.5	3.0	85	120/1	85	VERT CAB	B 030	1
VFC 72-4	VARIOUS	350	-	-	8.1	6.4	1.7	3.7	26.2	1.7	3.1	100	120/1	115	VERT CAB	B 040	1
VFC 72-5	CONFERENCE ROOMS	690	-	-	20.1	14.3	4.1	7.8	64.5	4.1	7.0	120	120/1	150	VERT CAB	B 080	1
HFC 72-6	CORRIDOR-1ST FLR	500	-	-	16.0	11.9	3.3	4.6	51.6	3.3	4.1	125	120/1	120	VERT REC	H 060	1,2
VFC 73-1	MAIN FOYER	350	-	-	11.2	7.9	2.3	9.0	33.5	2.3	7.4	100	120/1	80	VERT REC	H 040	1
HFC 73-3	BSMNT. CORR.	500	-	-	10.2	8.4	2.2	6.0	33.8	2.2	5.0	125	120/1	125	HOR CONC	C 060	1,2
VFC 73-4	1ST FLR STAIR	320	-	-	10.6	7.4	2.3	9.0	31.2	2.3	6.8	100	120/1	115	VERT CAB	B 040	1
VFC 73-5	3RD FLR STAIR	320	-	-	10.6	7.4	2.3	9.0	31.2	2.3	6.8	100	120/1	115	VERT CAB	B 040	1
HFC72/73-1	72/73 CONN.-GRND FLR	340	-	.2	8.6	6.5	2.0	5.2	29.1	2.0	4.3	145	120/1	70	HOR CONC	C 030	1,2
HFC72/73-2	72/73 CONN.-1ST FLR	480	-	.3	10.2	8.4	2.2	5.9	33.8	2.2	5.0	210	120/1	100	HOR CONC	C 040	1,2
HFC72/73-3	72/73 CONN.-2ND FLR	480	-	.3	10.2	8.4	2.2	5.9	33.8	2.2	5.0	210	120/1	100	HOR CONC	C 040	1,2
HFC72/73-4	72/73 CONN.-3RD FLR	480	-	.3	10.2	8.4	2.2	5.9	33.8	2.2	5.0	210	120/1	100	HOR CONC	C 040	1,2
HFC69/73-5	EAST CONN-GRND FLR	475	-	.2	9.7	7.9	2.0	5.4	31.6	2.0	4.6	210	120/1	80	HOR REC	H 040	1,2
HFC69/73-6	EAST CONN.-MAIN FLR	700	-	.2	18.8	14.3	4.0	6.6	60.1	4.0	6.0	320	120/1	120	HOR REC	H 060	1,2,3
HFC69/73-7	EAST CONN.-MAIN FLR	600	-	.2	18.8	14.3	4.0	6.6	60.1	4.0	6.0	320	120/1	120	HOR REC	H 060	1,2,3
HFC71/73-8	WEST CONN.-MAIN FLR	700	-	.2	18.8	14.3	4.0	6.6	60.1	4.0	6.0	320	120/1	120	HOR REC	H 060	1,2,3
HFC71/73-9	WEST CONN.-MAIN FLR	600	-	.2	18.8	14.3	4.0	6.6	60.1	4.0	6.0	320	120/1	120	HOR REC	H 060	1,2,3

1. BASED ON TRANE @ ARI COND. COOLINGS: EAT=80°FDB/67°FWB EWT=45°F, 10° TD; HEATING: EAT 70°F, EWT 180°F. (2 COILS)
2. PROVIDE HIGH STATIC MOTOR
3. PROVIDE R.A. T-STAT, CONTINUOUS FAN.

ABSORPTION CHILLERS (SINGLE EFFECT)

MARK	SERVICE/LOCATION	TONS	CHILLED WATER (deg F) GPM	CHILLED WATER EVT	CHILLED WATER LWT	CHILLED WATER P.D.	CHILLED WATER PASS	CONDENSER/ABSORBER GPM	CONDENSER/ABSORBER EWT	CONDENSER/ABSORBER LWT	CONDENSER/ABSORBER P.D.	CONDENSER/ABSORBER PASS	STEAM #/HR	STEAM PSIG	PUMP HP	PUMP VOLT/ø	OPER WT.	MODEL	NOTE(S)
ABS-1	MAIN M.E.R.	255	600	54	44	11.5	3	920	85	101	25	1+3	4850	13.0	7.5	480/3	19150	ABSC-256	1
ABS-2	MAIN M.E.R.	255	600	54	44	11.5	3	920	85	101	25	1+3	4850	13.0	7.5	480/3	19150	ABSC-256	1

1. BASED ON TRANE

CABINET HEATERS

MARK	SERVICE/LOCATION	CFM	OA	ESP	HEATING MBH	GPM	MAX. Pw	WATTS	ELEC V / ø	OPER. WT. #	TYPE	MODEL	NOTE(S)
CUH73-1	BSMNT / BLDG 73	380	-	-	21.7	1.0	1.1	65	120/1	115	V CAB,SLPTOP	B040	1
CUH73-2	BSMNT / BLDG 73	380	-	-	21.7	1.0	1.1	65	120/1	115	V CAB,SLPTOP	B040	1
CUH73-3	REAR ENRTRY / BLDG 73	300	-	-	23.1	1.0	1.3	65	120/1	100	V FULLY REC.	H030	1

1. BASED ON TRANE - EAT 70°F, EWT 180°F.

COOLING TOWER

MARK	SERV/LOCATION	GPM	RANGE EWT	RANGE LWT	APPR.	CFM	ELECT. CHAR. FAN HP	ELECT. CHAR. FAN HTRS.	ELECT. CHAR. V/ø	OPER. WEIGHT	MODEL	NOTE(S)
CT-1	AT GRADE	1840	101.5	85	9°	217,400	2@ 20	2@12KW	480/3	35,000	33373-2	1

1. BASED ON BALTIMORE AIR COIL @76°FWB, DOUBLE CELL.

HEAT EXCHANGER (STEAM / WATER)

MARK	SERV/LOCATION	NET MBH	EWT	LWT	GPM	MAX. Δ Pw	DIA X L	PASSES	SQ.FT HTG SURF.	MODEL	NOTE(S)
HEX-1	HTG WTR/M.E.R.	10,600	155°	185°	720	3.2	16 X 72	2	225.7	WS-1606	1
HEX-2	DHW / M.E.R.	702	40°	180°	10	< 1.0	6 X 48	4	18.3	WSX-0604	1,2

1. BASED ON ARMSTRONG @10 PSIG STEAM.
2. ALL BRONZE, DOUBLE WALL CONSTRUCTION FOR DHW SERVICE.

PUMPS

MARK	SERVICE/LOCATION	TYPE	FLOW GPM	HD FT.	SIZE	RPM	MOTOR HP	ELEC V / ø	MODEL	NOTE(S)
PCHVP-1	PRIM. CHV / MAIN M.E.R.	BMTD	600	30	6X5X10	1200	7.5	480/3	4030	1
PCHVP-2	PRIM. CHV / MAIN M.E.R.	BMTD	600	30	6X5X10	1200	7.5	480/3	4030	1
PHVP-1	PRIM. HV / MAIN M.E.R.	BMTD	360	20	5X4X8V	1200	3	480/3	4030	1,2
PHVP-2	PRIM. HV / MAIN M.E.R.	BMTD	360	20	5X4X8V	1200	3	480/3	4030	1,2
CVP-1	COND. WTR / MAIN M.E.R.	BMTD	920	75	6X5X10	1000	25	480/3	4030	1
CVP-2	COND. WTR / MAIN M.E.R.	BMTD	920	75	6X5X10	1000	25	480/3	4030	1
SCHVP-69/72	SEC. CHV / MAIN M.E.R.	BMTD	345	100	4X3X11.5	1800	15	480/3	4030	1,3
SCHVP-70/71	SEC. CHV / MAIN M.E.R.	BMTD	340	100	4X3X11.5	1800	15	480/3	4030	1,3
SCHVP-73	SEC. CHV / MAIN M.E.R.	BMTD	280	45	4X3X8	1800	5	480/3	4030	1,3
FUTURE BLD	SEC. CHV / MAIN M.E.R.	BMTD	-	-	-	-	-	-	-	4
SHVP-69/72	SEC. HV / MAIN M.E.R.	BMTD	224	100	4X3X10	1800	10	480/3	4030	1,3
SHVP-70/71	SEC. HV / MAIN M.E.R.	BMTD	161	100	3X2.5X10	1800	7.5	480/3	4030	1,3
SHVP-73	SEC. HV / MAIN M.E.R.	BMTD	160	45	3X2.5X8	1800	3.0	480/3	4030	1,3
FUTURE BLD	SEC. CHV / MAIN M.E.R.	BMTD	-	-	-	-	-	-	-	4

1. BASED ON ARMSTRONG
2. PUMPS OPERATE IN PARALLEL
3. PUMP MOTOR SHALL BE FOR INVERTER DUTY
4. N.I.C.

HOT WATER UNIT HEATERS (HW)

MARK	SERVICE/LOCATION	CFM	CAPACITY MBH	GPM	ELEC V / ø	MAX. Δ Pw	MOTOR HP	MODEL	NOTE(S)
UH 69A-1	ATTIC MECH. RM	1790	63.0	5	120/1	< 1.0	1/6	122-P	1
UH 69-1	MECH RMS / GRND FLR	280	4.0	1.0	120/1	< 1.0	1/25	18-S	1
UH 69-2	ATTIC-WEST MECH RM	2620	90.8	7.5	120/1	< 1.0	1/6	166-P	1
UH 69-3	ATTIC-EAST MECH RM	1528	52.0	4.0	120/1	< 1.0	1/8	102-P	1
UH 70-1	MECH RM / BLDG 70	280	4.0	1.0	120/1	< 1.0	1/25	18-S	1
UH 71-1	MECH RM / 1ST FLR	280	4.0	1.0	120/1	< 1.0	1/25	18-S	1
UH 71-2	ATTIC-EAST MECH. RM	2620	90.8	7.5	120/1	< 1.0	1/6	166-P	1
UH 71-3	ATTIC-WEST MECH. RM	1528	52.0	4	120/1	< 1.0	1/8	102-P	1
UH 72-1	ATTIC-MECH. RM	2630	90.8	7.5	120/1	< 1.0	1/6	166-P	1
UH 73-1	M.E.R. / BLDG 73	815	27.4	3.0	120/1	< 1.0	1/20	60-S	1
UH 73-2	STORAGE / BSMNT 73	543	14.3	1.5	120/1	< 1.0	1/20	38-S	1
UH 73-3	STORAGE / BSMNT 73	543	12.0	1.0	120/1	< 1.0	1/20	38-S	1
UH 73-4	SPRKLR. STOR / BSMNT 73	315	6.0	1.0	120/1	< 1.0	1/25	20-S	1

1. BASED ON TRANE @180° EWT WITH LOUVER FIN OR LOUVER CONE DIFFUSER AS APPROPRIATE.

FINNED TUBE RADIATION

MARK	SERVICE/LOCATION	BTU/FT	ELEMENT MAT	ELEMENT TUBE	ELEMENT SIZE	ELEMENT FPI	ENCLOSURE TYPE	ENCLOSURE HT	MODEL	NOTE(S)
XX	BSMNT 69A	700	ALUM	COPPER	3/4	40	EXPANDED METAL	-	-	1
XX	-	-	-	-	-	-	-	-	-	1

XX — TYPE / ACTIVE LENGTH

1. BASED ON STERLING

SA·GCA Architects
An association of Saccoccio & Associates And Goody, Clancy & Associates
28 Garfield Avenue, Cranston, R.I. 02920
tel 401. 942. 7970
fax 401. 942. 7975

RENOVATION AND RESTORATION OF CENTER GENERAL COMPLEX

FOR
THE STATE OF RHODE ISLAND
DEPARTMENT OF LABOR AND TRAINING
NEW HEADQUARTERS BUILDING
PONTIAC AVENUE
CRANSTON, RHODE ISLAND

CAI CONSULTING ENGINEERS
CATAUDELLA ASSOCIATES, INC.
1223 MINERAL SPRING AVENUE
NORTH PROVIDENCE, RI 02904
401-728-1122

7/24/98

No.	REVISIONS	DATE

TITLE:

HVAC SCHEDULES

SA Job No. 97112	GCA Job No. 3940
DRAWN: XX	DATE:
CHECKED: JSC	DRAWING: NO SCALE

L. S. CATAUDELLA NO. 3696 REGISTERED PROFESSIONAL ENGINEER

M3.01

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FANS

MARK	SERVICE/LOCATION	CFM	TSP	FAN TYPE	WHEEL TYPE	WHEEL DIA.	MAX RPM	MOTOR HP	ELEC V / ø	OPER WEIGHT	MODEL	NOTE(S)
REF69A-1	TOILETS/ROOF 69A	450	.5	ROOF/D	CENT	8	1400	1/8	120/1	60	VEDK 08	1, 2
REF69A-2	BREAK RMS/ROOF 69A	200	.5	ROOF/D	CENT	6	1000	1/8	120/1	60	VEDK 06	1, 2
EF69A-3	ELEC. RM / BSMNT	800	.25	INLN/D	PROP	12	1500	1/6	120/1	50	LYDK 12K2	1, 2
EF69-1	TOILETS/ATTIC	1350	.63	INLN/D	CENT	15	1025	1/3	120/1	100	VIDK 15	1, 2
EF69-4	BREAK RMS/ATTIC	300	.5	INLN/D	CENT	–	1050	230V	120/1	–	VCDB 045	1, 2
RAF69-5	AHU 69-5/GRND STORAGE	2775	.5	INLN/D	CENT	18	1000	1½V	120/1	100	VIBK 18	1, 2
RAF69-6	AHU 69-6/GRND JANITORS	1015	.38	INLN/D	CENT	10	1500	1/2	480/3	100	VIDK 10	1, 2
EF69-7	ELEV MACHINE RM	60	.25	CEIL/D	CENT	–	1500	35W	120/1	–	VCDB 008	1, 2
EF69-8	GRND FLR JANITORS CLOSET	60	.25	CEIL/D	CENT	–	1500	35W	120/1	–	VCDB 008	1, 2
EF69-9	ELEC. RM. / LOWER LEVEL	800	.38	INLN/D	CENT	10	1200	1/3	120/1	80	VIDK 10	1, 2
EF 70-1	ELEV. MACH. RM. / BLDG 70	300	.5	CEIL/D	CENT	–	1100	480V	120/1	–	VCDB 075	1,2
REF 70-2	TOILETS / BLDG 70	1200	.5	ROOF	CENT	10	1500	1/2	480/3	75	VEDK 10	1,2
REF 70-3	MECH. RM. / 1ST FLR.	800	.25	PNL/D	PROP	12	1200	1/3	120/1	50	LYDK 12K2	1
EF71-1	TOILETS/ATTIC	1350	.63	UTILITY	CENT	15	1025	1/3	120/1	100	VIDK 15	1, 2
EF71-2	JANITORS CLOS./ATTIC	120	.38	INLN/D	CENT	–	1575	150W	120/1	–	VCDB 030	1, 2
EF71-3	BREAK RMS	300	.5	INLN/D	CENT	–	1050	230V	120/1	–	VCDB 045	1, 2
EF71-4	ELEC. RM. EXH./1ST FLOOR	960	.25	PNL/D	PROP	14	1200	1/2	480/3	50	LYDK 14P2	1
EF72-1	WOMANS TOILETS, SHOWERS	175	.38	INLN/D	CENT	–	1575	150W	120/1	–	VCDB 030	1, 2
EF72-2	MENS TOILETS, SHOWRRS	250	.38	INLN/D	CENT	–	1100	230V	120/1	–	VCDB 045	1, 2
EF72-3	WORK ROOM, WORKOUT	200	.25	CEIL/D	CENT	–	1600	150W	120/1	–	VCDB 030	1, 2
EF72-4	ELECTRICAL ROOM	800	.25	PNL/D	PROP	12	1500	1/6	120/1	–	LYDK 12K2	1
EF72-5	NORTH TOILETS	775	.38	INLN/D	CENT	–	1050	350W	120/1	–	VCDB 095	1, 2
RAF72-6	AHU72-2 / GRND MECH	930	.50	INLN/D	CENT	10	1300	1/2	480/3	85	VIDK 10	1, 2
RAF72-7	AHU72-3 / GRND MECH	1000	.50	INLN/D	CENT	10	1500	1/2	480/3	85	VIDK 10	1, 2
EF72-8	PRIV.TOILET/ ATTIC	75	.38	INLN/D	CENT	–	1000	110V	120/1	85	VCDB 015	1, 2
EF72-9	BREAK RMS, CONF./ATTIC	200	.35	INLN/D	CENT	–	1575	150W	120/1	–	VCDB 030	1, 2
EF 73-1	KIT. TOILET / BLDG 73	75	.38	CEIL/D	CENT	–	1325	60V	120/1	–	VCDB 010	1,2
REF 73-2	KITCHEN HOOD / BLDG 73	1600	1.5	ROOF/B	CENT	15	1450	1 1/2	480/3	130	VRBK 15	1,3
EF 73-3	BREAK ROOM / 2ND FLR	100	.25	CEIL/D	CENT	–	1625	110V	120/1	–	VCDB 015	1,2,4
EF 73-4	BREAK ROOM / 3RD FLR	100	.25	CEIL/D	CENT	–	1625	110V	120/1	–	VCDB 015	1,2,4
REF 73-5	TOILETS/ROOF	1350	.5	ROOF/D	CENT	12	1500	1/2	480/3	70	VEDK 12	1,2
REF 73-6	ELEV MACHINE RM/ ROOF	930	.8	ROOF/D	CENT	10	1200	1/4	120/1	85	VEDK 10	1,2
REF 73-7	M.E.R. VENT.	3500	.125	PNL/D	PROP	21	1000	1/2	480/3	100	LYDK 21P3	1,5

1. BASED ON CARNES
2. PROVIDE VARIABLE SPEED SWITCH AT FAN FOR BALANCING
3. SHALL MEET NFPA 96 REQUIREMENTS FOR GREASE LADEN AIR, PROVIDE EXTENDED CURB WITHOUT DAMPER
4. PROVIDE VXCAB 245 EXTRUDED ALUM. BRICK VENT.
5. PROVIDE WALL COLLAR, MENA 1 DISC. ALL ALUMINUM CONSTRUCTION.

VAV MODULES

MARK	SERVICE/LOCATIION	TYPE	SERIES	CFM MAX	CFM MIN	MAX. APD	HV REHEAT MBH	HV REHEAT GPM	HV REHEAT MAX. VPD	MODEL	NOTE(S)
VAV69-1	CONF. RM/ 2ND FLOOR	THROT	AVV	900	450	.25	17.0	2.0	2.0	10	1
VAV69-2	CONF. RM./ 1ST FLOOR	THROT	AVV	900	450	.25	17.0	2.0	2.0	10	1
VAV69-3	MEETNG RM./ GRND FLOOR	THROT	AVV	500	250	.25	12.5	3.0	2.8	8	1
VAV70-1	CONF. RM/ 2ND FLOOR	THROT	AVV	1300	650	.25	25.0	3.0	< 1.0	12	1,2
VAV70-2	CONF. RM./ 3RD FLOOR	THROT	AVV	1300	650	.25	25.0	3.0	< 1.0	12	1,2
VAV71-1	CONF. RM/ 3RD FLOOR	THROT	AVV	900	450	.25	17.0	2.0	2.0	10	1
VAV71-2	CONF. RM./ 2ND FLOOR	THROT	AVV	900	450	.25	17.0	2.0	2.0	10	1
VAV72-1	CONF. RM.	THROT	AVV	500	250	.25	17.0	3.0	2.8	8	1
VAV 73-1	MTG RM / 3RD FLR	THROT	AVV	1800	900	.25	35.0	4.0	1.7	14	1
VAV 73-2	ASSOC DIR / 3RD FLR	THROT	AVV	900	450	.25	17.0	2.0	2.0	10	1
VAV 73-3	CONF RM / 3RD FLR	THROT	AVV	800	400	.25	17.0	2.0	2.0	10	1
VAV 73-4	2ND MTG RM / FOYER	THROT	AVV	1700	850	.25	35.0	4.0	1.7	14	1
VAV 73-5	MRG ROOM / 2ND FLR	THROT	AVV	640	320	.30	12.5	3.0	2.8	8	1
VAV 73-6	SUPERVISOR / 2ND FLR	THROT	AVV	500	250	.25	12.5	3.0	2.8	8	1
VAV 73-7	CONF RM / 1ST FLR	THROT	AVV	600	300	.25	12.5	3.0	2.8	8	1
VAV 73-8	CLASSROOM / 1ST FLR	THROT	AVV	600	300	.25	12.5	3.0	2.8	8	1

1. BASED ON CARNES AVV SERIES
2. 1 ROW HV COIL, AND SOUND ATTENUATOR

ELECTRIC HEATERS

MARK	SERVICE/LOCATION	TOTAL CAPACITY	ELECT. CHAR.	* MODEL	NOTE(S)
EUH69A-1	ELEC. SPACES/BLDG 69A	3.0 KW	208/1	MUH03-B1	1
EUH71-1	ELEC. RM /BLDG 71	3.0 KW	208/1	MUH03-B1	1
EUH72-1	VARIOUS/BLDG 72	3.0 KW	208/1	MUH03-B1	1

1. BASED ON Q-MARK W/UNIT MOUNTED T-STAT, UNIVERSAL SUPPORT

KITCHEN EXHAUST HOOD

MARK	CFM	SIZE	MAX △ P	OPER VGHT	MODEL	REMARKS
EH-1	1600	96X48	1.0	450 #	GHFV	1

1. BASED ON GREENHECK, SINGLE SHELL, FULL COMPENSATING WITH FIRE DAMPER IN SUPPLY COLLAR

CONDENSATE RETURN SETS (DUPLEX)

MARK	SERVICE/LOCATION	GPM	RECEIVER (GAL)	DISC. PRESS.	ELEC V / ø	MOTOR HP	MODEL	NOTE(S)
CR-1	MECH. EQUIP. RM. / #73	75	121	30 PSIG	480/3	2 @ 1.5 hp	CVV-5030	1

1. BASED ON FEDERAL PUMP @ 3500 RPM.

COMPUTER ROOM UNITS

MARK	SERV/LOCATION	AIR CAPACITY TOTAL	AIR CAPACITY ESP	AIR CAPACITY FAN HP	SYSTEM CAPACITY TOT. MBH	SYSTEM CAPACITY SEN MBH	REHEAT KW	REHEAT STGS	HUMIDIFIER #/HR	HUMIDIFIER KW	ELECTRICAL CHAR. V / ø	ELECTRICAL CHAR. FLA	ELECTRICAL CHAR. OPD	OPER. WEIGHT	MODEL	NOTE(S)
AC-1	SERVER ROOM	2300	.3	1.0	39.8	37.6	9	2	11	4.8	460/3	28.4	25	600	BF042A	1
AC-2	COMP. RM. (SM)	3000	.3	2.0	59.9	53.0	15	2	11	4.8	460/3	33.1	45	650	BF067A	1
AC-3	COMP. RM. (LG)	3000	.3	2.0	59.9	53.0	15	2	11	4.8	460/3	33.1	45	650	BF067A	1
AC-4	COMP. RM. (LG)	3000	.3	2.0	59.9	53.0	15	2	11	4.8	460/3	33.1	45	650	BF067A	1

1. BASED ON LIEBERT, WITH INFARED HUMIDIFIER

AIR COOLED CONDENSER UNITS

MARK	SERVICE/LOCATION	CAP. MBH	ELECTRICAL CHARACTERISTICS V / ø	HP	FLA	OPD	OPER WEIGHT	MODEL	NOTE(S)
CU 1	AC-1 / AT GRADE	39.8	480/3	3/4	2.4	15	300	CSL-083L	1
CU 2	AC-2 / AT GRADE	59.9	480/3	3/4	2.4	15	300	CSL-083L	1
CU 3	AC-3 / AT GRADE	59.9	480/3	3/4	2.4	15	300	CSL-083L	1
CU 4	AC-4 / AT GRADE	59.9	480/3	3/4	2.4	15	300	CSL-083L	1

1. BASED ON LIEBERT, 95°F AMBIENT GROSS. PROVIDE FAN SPEED CONTROL FOR MIN. 0°F AMB. OPERATIONS. 5/8 OD LIQ, 7/8 OD HOT GAS.

LINEAR DIFFUSERS & REGISTERS

MARK	SIZE	SERVICE	SLOTS SIZE	SLOTS QTY	BLADES SPCNG	BLADES REF.	MODEL	NOTES
(1A)	72X8	SUPPLY	1"	4	–	–	CHFB	1
(1B)	72X3.5	SUPPLY	–	–	1/4"	0°	CTGB	1,2
(1C)	36X3.5	SUPPLY	–	–	1/4"	0°	CTGB	1,2
(1D)	48X4	SUPPLY	–	–	1/4"	0°	CTGB	1,2
(1E)	72X4	SUPPLY	–	–	1/4"	0°	CTGB	1,2
(1F)	96X4	SUPPLY	–	–	1/4"	0°	CTGB	1,2
(1G)	72X4	SUPPLY	3/4"	3	–	–	CHDB	1
(1H)	48X4	SUPPLY	1"	2	–	–	CHFB	1
(1I)	72X4	SUPPLY	1"	2	–	–	CHFB	1
(1J)	96X6	SUPPLY	–	–	1/4"	0°	CTLB	1,2,3
(1K)	96X8	RET	–	–	1/2"	15° UP	CWPB	1,2

1. BASED ON CARNES
2. D.B. VOLUME CONTROL DAMPER
3. DEBRIS SCREEN FOR FLOOR MOUNTING

REGISTERS, GRILLES, DIFFUSERS

MARK	SIZE	SERVICE	TYPE	REAR BLADE	MODEL	NOTES
(A)	6X6	SUPPLY	DIFF	–	SK	1
(B)	9X9	SUPPLY	DIFF	–	SK	1
(C)	12X12	SUPPLY	DIFF	–	SK	1
(D)	15X15	SUPPLY	DIFF	–	SK	1
(E)	18X18	SUPPLY	DIFF	–	SK	1
(F)	8X4	SUPPLY	REG	–	RTDAH	1,2
(G)	6X9	SUPPLY	DIFF	–	SK	1
(H)	6X12	SUPPLY	DIFF	–	SK	1
(I)	12X12	SUPPLY	REG	45	RTDAH	1,2
(J)	12X6	SUPPLY	REG	22/45	RTDAH	1,2
(K)	10X6	SUPPLY	REG	45	RTDAH	1,2
(L)	12X8	SUPPLY	REG	22/45	RTDAH	1,2
(L)	18X8	SUPPLY	REG	45	RTDAH	1,2
(Z)	24X8	SUPPLY	REG	45	RTDAH	1,2
(L3)	30X10	SUPPLY	REG	–	RTDAH	1,2
(L4)	12X16	SUPPLY	REG	45	RTDAH	1,2
(M)	8X8	RET/EXH	REG	–	RTLAH	1
(N)	10X10	RET/EXH	REG	–	RTLAH	1
(P)	12X12	RET/EXH	REG	–	RTLAH	1
(Q)	16X16	RET/EXH	REG	–	RTLAH	1
(R)	22X22	RET/EXH	REG	–	RTLAH	1
(S)	24X18	RET	REG	–	RTLAH	1
(T)	22X8	RET	REG	–	RTLAH	1
(U)	36X8	RET	REG	–	RTLAH	1
(V)	20X10	RET	REG	–	RTLAH	1
(W)	16X12	RET	REG	–	RTLAH	1
(MA)	36X48	SUPPLY	REG	45	RTDAH	1,2
(MB)	36X48	RET	REG	–	RTHAH	1,2,3
(MC)	30X48	RET	REG	–	RTHAH	1,2,3
(MD)	24X36	RET	REG	–	RTHAH	1,2,3
(ME)	48X48	RET	REG	–	RTHAH	1,2,3
(MF)	60X36	RET	REG	–	RTHAH	1,2,3
(MG)	60X24	RET	REG	–	RTHAH	1,2,3
(MH)	48X30	RET	REG	–	RTHAH	1,2,3
(MJ)	24X18	RET	REG	–	RTHAH	1,2,3
(MK)	24X24	RET	REG	–	RTHAH	1,2,3
(ML)	36X60	RET	REG	–	RTHAH	1,2,3

1. BASED ON CARNES, W/ VOLUME CONTROL DAMPERS
2. DOUBLE DEFLECTION, HORIZ. FRONT BALDE.
3. HEAVY DUTY CONSRUCTION, 40° DEFLECTION. MOUNT AT 8' AFF.

LEGEND:

ONE WAY — THREE WAY — EXHAUST AIR

TWO WAY CORNER — FOUR WAY — RETURN AIR

TWO WAY — INDICATES TYPE AND/OR SERVICE — INDICATES SIZE — ### INDICATES CFM

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RENOVATION AND RESTORATION OF CENTER GENERAL COMPLEX

FOR
THE STATE OF RHODE ISLAND
DEPARTMENT OF LABOR AND TRAINING
NEW HEADQUARTERS BUILDING
PONTIAC AVENUE
CRANSTON, RHODE ISLAND

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7/24/98

No.	REVISIONS	DATE

TITLE:

HVAC SCHEDULES

SA Job No. 97112	GCA Job No. 3940
DRAWN: XX	DATE:
CHECKED: JSC	DRAWING: NO SCALE

M3.02

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