

**AHS  
MODERNIZATION/  
HVAC UPGRADE**

ALBEMARLE COUNTY  
PUBLIC SCHOOLS  
2775 HYDRAULIC ROAD  
CHARLOTTESVILLE, VA  
22901

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PROJECT NUMBER:  
2016.40

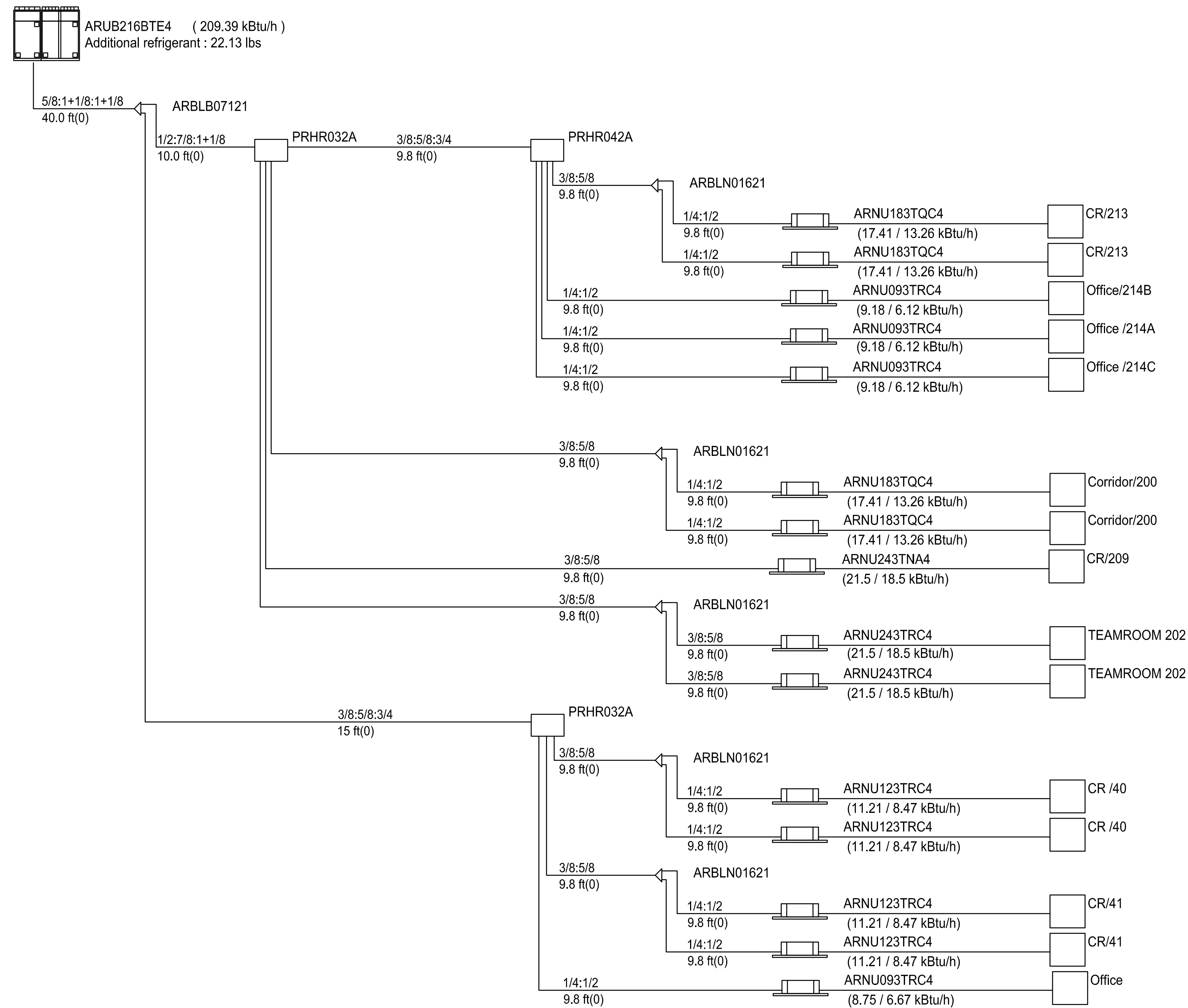
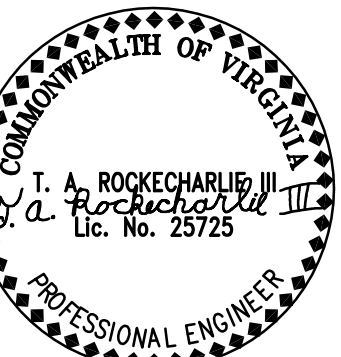
PROJECT MANAGER:  
TAR

DRAWN BY:  
TAR III

ISSUE DATE:  
3/24/2017

BID DOCUMENTS

REVISIONS:



**VRF SYSTEM NO. 1 PIPING SCHEMATIC**

SCALE : NONE

**VRF REFRIGERANT VOLUME CALCULATION**

ROOM NAME	ROOM VOLUME (CU. FT.)	ALLOWABLE POUNDS OF REFRIGERANT (ASHRAE STD. 15)
OFFICE	*9564	249
SMALL CLASSROOM	4884	127
MEDIUM CLASSROOM	6105	159
LARGE CLASSROOM	7530	196
SYSTEM NO. 1: TOTAL SYSTEM CHARGE = 60 POUNDS OF R410A.		
* INCLUDES VOLUME OF ADJACENT ROOM VIA TRANSFER GRILLE.		

**VENTILATION CALCULATION (TYPICAL CLASSROOM)**

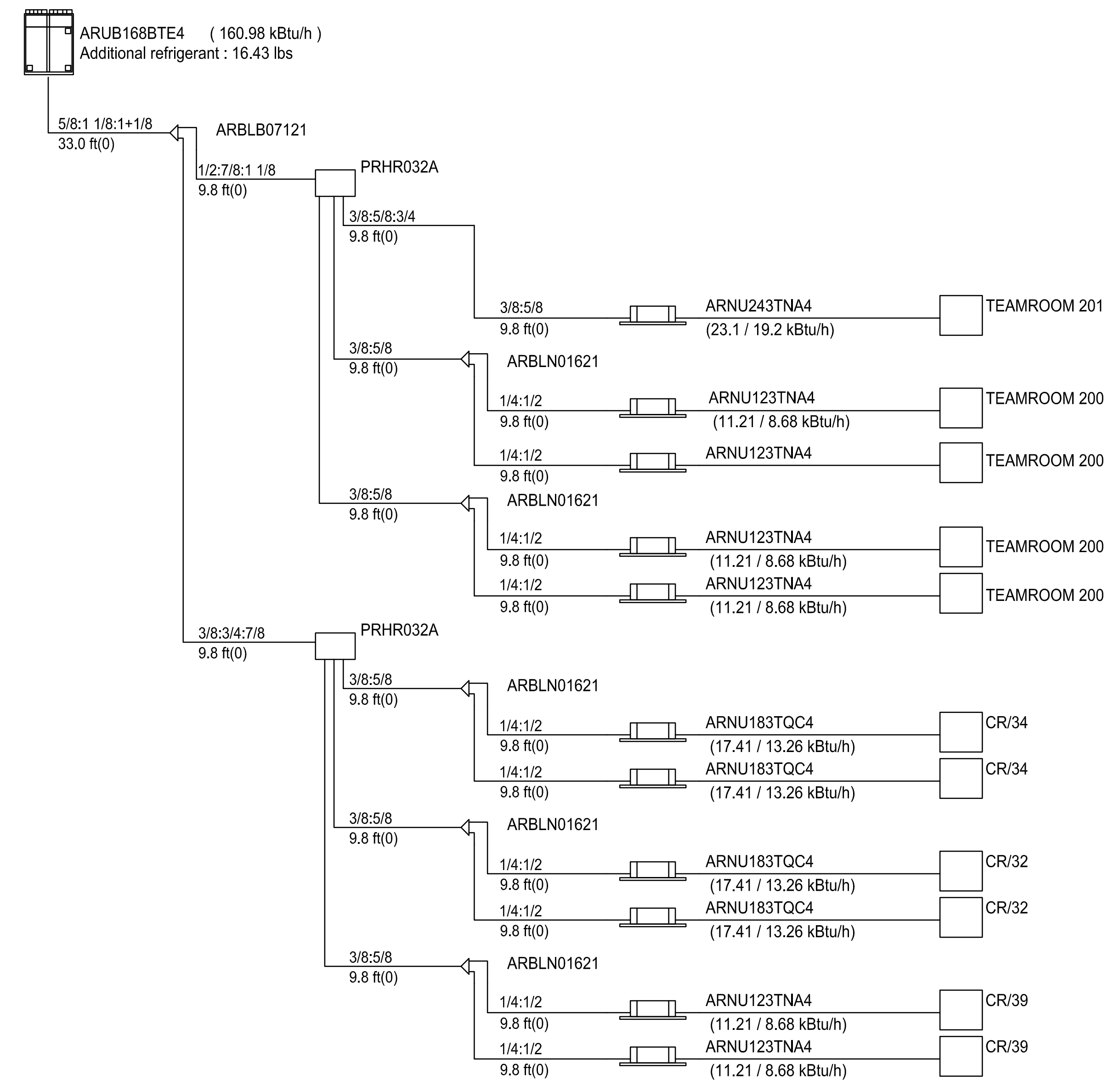
VARIABLE	VALUE
ASHRAE EQUATION	5
SPACE TYPE	CLASSROOM 9+
AREA (SF)	814 MAX
NUMBER OF PEOPLE	25
EMISSION RATE PER PERSON	260 UG/MIN
CONTAMINANT GENERATION RATE (N)	6500 UG/MIN
ZONE AIR DISTRIBUTION EFFECTIVENESS (Ez)	0.8
OUTDOOR AIR FLOW RATE (Voz)	200
FILTER EFFICIENCY (Ef)	0.68
CONTAMINANT CONCENTRATION (Co)	1.2 UG/CU. M
RECIRCULATION FLOW VARIABLE (R=Vr/Vo+Vr)	0.75
SUPPLY AIR FLOW RATE (Vs)	800 CFM
RETURN AIR FLOW RATE (Vr)	600 CFM
OUTSIDE AIR FLOW RATE (Vo)	200 CFM MIN.
CONTAMINANT CONCENTRATION ZONE (Cbz)	0.802 PPM
IAQ OUTSIDE AIR FLOW RATE PER PERSON	8.0 CFM
$Cbz = \frac{N+Ez \cdot VozCo(1-Ef)}{Ez \cdot (Voz+R \cdot Vr \cdot Ef)}$	

BASED ON 2012 IMC SECTION 403.2 EXCEPTION FOR CONTAMINANT DILUTION DESIGN.  
8 CFM PER PERSON X 25 PEOPLE = 200 CFM PER ROOM MIN. REQUIRED. 250 CFM PROVIDED.

**VENTILATION CALCULATION (TYPICAL OFFICE)**

VARIABLE	VALUE
ASHRAE EQUATION	5
SPACE TYPE	OFFICE
AREA (SF)	220 MAX
NUMBER OF PEOPLE	5
EMISSION RATE PER PERSON	260 UG/MIN
CONTAMINANT GENERATION RATE (N)	1300 UG/MIN
ZONE AIR DISTRIBUTION EFFECTIVENESS (Ez)	0.8
OUTDOOR AIR FLOW RATE (Voz)	20
FILTER EFFICIENCY (Ef)	0.68
CONTAMINANT CONCENTRATION (Co)	1.2 UG/CU. M
RECIRCULATION FLOW VARIABLE (R=Vr/Vo+Vr)	0.93
SUPPLY AIR FLOW RATE (Vs)	300 CFM
RETURN AIR FLOW RATE (Vr)	280 CFM
OUTSIDE AIR FLOW RATE (Vo)	20 CFM MIN.
CONTAMINANT CONCENTRATION ZONE (Cbz)	0.413 PPM
IAQ OUTSIDE AIR FLOW RATE PER PERSON	4.0 CFM
$Cbz = \frac{N+Ez \cdot VozCo(1-Ef)}{Ez \cdot (Voz+R \cdot Vr \cdot Ef)}$	

BASED ON 2012 IMC SECTION 403.2 EXCEPTION FOR CONTAMINANT DILUTION DESIGN.  
4 CFM PER PERSON X 5 PEOPLE = 20 CFM PER ROOM MIN. REQUIRED. 20-40 CFM PROVIDED.  
OAU#1 SIZING BASED ON 10 CLASSROOMS AT 250 CFM EACH, 2 AT 200 CFM EACH, 1 OFFICE AT 40 CFM, AND 3 OFFICES AT 20 CFM EACH.

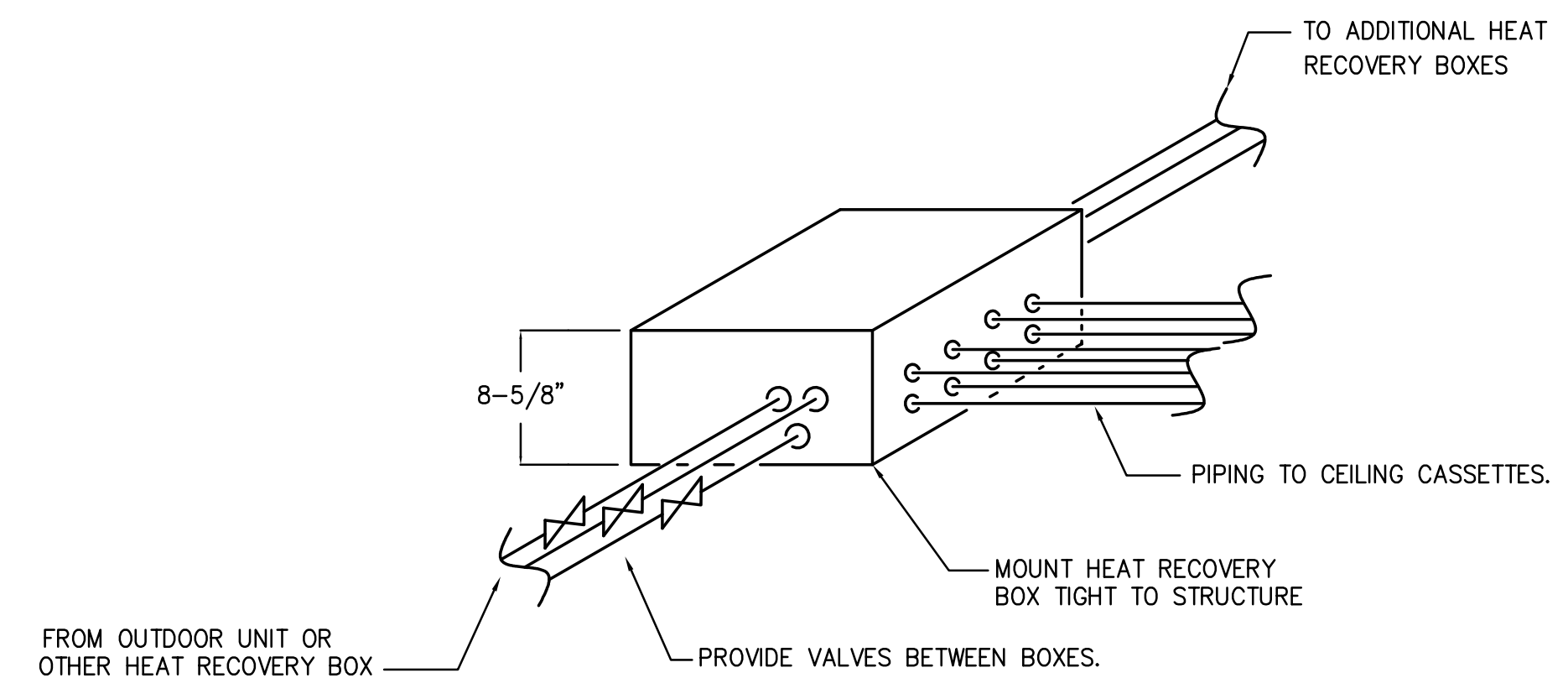


**VRF SYSTEM NO. 2 PIPING SCHEMATIC**

SCALE : NONE

**VRF REFRIGERANT VOLUME CALCULATION**

ROOM NAME	ROOM VOLUME (CU. FT.)	ALLOWABLE POUNDS OF REFRIGERANT (ASHRAE STD. 15)
SMALL CLASSROOM	4884	127
MEDIUM CLASSROOM	6105	159
LARGE CLASSROOM	7530	196
SYSTEM NO. 2: TOTAL SYSTEM CHARGE = 43 POUNDS OF R410A.		



**TYPICAL HEAT RECOVERY BOX DETAIL**

SCALE : NONE

NOTE:  
VERIFY ALL REFRIGERANT PIPE  
SIZING WITH MANUFACTURER  
PRIOR TO BID.

SHEET TITLE:  
REFRIGERANT PIPING  
DIAGRAMS AND  
VENTILATION CALCULATIONS

SHEET NUMBER:

**M302**