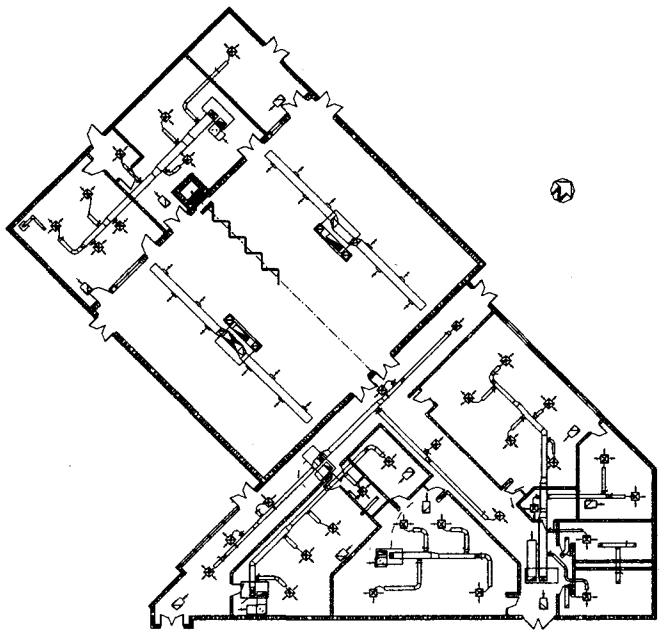
ME 750I

Advanced HVAC Design Final Project

Sunset Elementary School Addition



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12-10-01

Attachments:

Cut Sheets:

- Heavy Duty Gym Grills
- Supply Diffusers
- Return Grills
- Exhaust Fans
- Roof Top Unit Specifications

Figure 1: Floor Plan and Wall Types

Figure 2: Zone Layout

Figure 3: Roof Top Units

Figure 4: Tentative Schematic of Ducts

Figure 5: Ceiling Grid and Diffuser Layout

Figure 6: Details of Unit

Introduction:

Location:

Sunset Elementary School located on 1510 w. Republic Avenue in Salina Kansas.

Purpose:

We are going to completely design an HVAC system to satisfy the comfort conditions on September 1, 2001.

Design:

Our project is a 15,000 square foot expansion to the Sunset Elementary School. The floor plan (Fig.1) gives a complete layout of our project and shows which way the building is facing. The way the building is facing has a major impact on the design of the system. The walls were all measured and calculations were made for areas for the amount of exposure for each room.

The next phase of the project was to figure out the number of people and appliances that would be occupying the rooms during the specific day that we chose. All of these numbers can be found in References attachment and those numbers were used for the cooling loads calculations, which can be found in Cooling Load Calculations, which is attached. We then looked at the floor plan (Fig 1) and decided on the zones that we would use for the project. We decided the zones based on similarities in sun exposure and what the rooms would be used for. The zone plan drawing can be found in Fig. 2.

We also decided to go ahead and place the air conditioning units on our structure. The Trane units that we used (the exact unit number and size will be finalized for the final report) were place on the structure based on the structural integrity of the building and would be certified by a structural engineer before the design is completed. This drawing can be found in Fig. 3. We also drafted a tentative schematic of the ductwork that will used to deliver the conditioned air to our rooms and they can found on the Schematic Ductwork drawing in Fig. 4.

Figure 5 presents the ceiling grid and diffuser layout , and figure 6 provides the detailed of the units.

Cooling Load Calculations:

Before selecting the air conditioning unit for the each zone, required capability of the units must be determined. The unit needs to be able to handle the cooling load for the zone, and also have the ability to provide enough air for the circulation, including adding fresh air from the outside while maintaining the temperature and moisture at a desired range. The cooling loads will be determined by considering these factors; occupants' activities, appliances being used, and heat from outside by conduction, radiation or infiltration.

Assumptions:

To calculate the cooling load, these assumptions are set.

- The gender ratio of the elementary school is 1:1. The values of heat generation from adult are the average of both male and female.
- Students are considered as children.
- The sample climate data of Salina, Kansas is based on the information provided by the National Weather Service of Wichita on September 1st, 2001. The enthalpy values include the components of water vapor.
  - 8:00 A.M.: $66°F_{DB}$ $56°F_{WB}$ $\Phi = 69\%$ $i = 23.6$ Btu/lbm_{air}
  - 12:00 P.M.: $80°F_{DB}$ $55°F_{WB}$ $\Phi = 42\%$ $i = 23.2$ Btu/lbm_{air}
  - 5:00 P.M.: $85°F_{DB}$ $54°F_{WB}$ $\Phi = 34\%$ $i = 23.0$ Btu/lbm_{air}
- The climate condition of the building should be shown as below,
  - Target $73°F_{DB}$ $58°F_{WB}$ $\Phi = 40\%$ $i = 25.0$ Btu/lbm_{air}
- The level of the activities in selected hours remains constant.

Heat Generations:

Heat Generation by Occupants:

The values of heat generated by people in the building for various activities are referred from the *Standard Handbook of Architectural Engineering*; table 4-11: Metabolism of Human Activities (P.480). The ratios of the sensible and latent heat for each activity are derived from the *ASHRAE handbook 2001*; table 8.18 (P.842). The table describes the values used for the evaluation.

Table A-1: Heat Generation in Sensible and Latent Heat

Activity:	Heat Generation (Btu/hr)			% Heat Ratio		Adult (Btu/hr)		Child (Btu/hr)	
	Male	Female	Child	Sensible	Latent	Sensible	Latent	Sensible	Latent
Walking	800	680	600	50%	50%	370	370	300	300
Eating	520	450	400	55%	45%	267	218	220	180
Cooking	1600	1300	N/A	40%	60%	580	870	N/A	N/A
Office work	640	540	N/A	55%	45%	325	266	N/A	N/A
Classroom	480	410	360	60%	40%	267	178	216	144

Heat Addition from Appliances:

Appliances being used during the hours are another factors adding heat into the rooms. All rooms have lighting, and in addition, each room has different kind of appliances. For example, the kitchen has refrigerator, freezer, dishwasher, hot / cold bars and ranges. The values are taken from the *ASHRAE handbook 2001*.

Table A-2: Table of Heat Generation from Appliances

Item	Location(s)	Heat (Btu/hr)
Large Refrigerator	Kitchen	300
Large Freezer	Kitchen	1,840
Dish Washer (Conveyer, Water Sanitized, Hood Equipped)	Kitchen	190
Range (Hot Box)	Kitchen	2,690
Food Warmer (Hot Bar)	Kitchen	990
Cold Bar (50% of hot bar)	Kitchen	495
Computer	Kitchen	1,366
Vending Machine	Staff Planning	940
Hand Dryer	Restrooms	1,366
Beverage Dispenser	Kitchen	2,562
Copy Machine	Staff Planning	290
Microwave Oven	Staff Planning	1,366
Fluorescence Light (26W) (94% of its Watt value)	Rooms, Hallways	90
Fluorescence Light (32W) (94% of its Watt value)	Rooms, Hallways	103
400W Light (114% of its Watt value)	Gymnasium	1,557

Infiltration:

Infiltration occurs even there are almost no traffics between in and out of the building. The air can be entering into the building though cracks or gaps in windows, walls or roofs. The building selected has only eleven windows so the infiltrations through crack of window frames are negligible. There are thirty doors but all doors to the outside remain closed during the school hours, thus the air volume change due to traffics during the hours are also very small. The only considerable factor was infiltration due to the cracks between walls and roofs, which were calculated from the size of the room. The air mass of the room and the difference in enthalpy gives total energy difference. The enthalpy for morning, noon and evening to the room were determined from the formula in McQuiston's "*Heating, Ventilating, and Air Conditioning, Fifth Edition*", equation 3-20a (P. 53), the added value due to the water vapor was referred from table A-1a Properties of Refrigerant 718 (Water-Steam) – English unit (P. 586).

Table A-3: Heat Generation due to the Infiltration

Location					Difference in Btu/lb_{air}			Energy (Btu/hr)		
Zone	Room	V (cfm)	V (ft^3/hr)	Mass (lb_{air}/hr)	Morning	Noon	Evening	Morning	Noon	Evening
1	Kitchen	41.0	2460	5.85	-1	4.2	5.1	-6	25	30
	Vest	15.0	900	2.14	-1	4.2	5.1	-2	9	11
	Maintenance	21.7	1302	3.09	-1	4.2	5.1	-3	13	16
	P.E. Storage	41.0	2460	5.85	-1	4.2	5.1	-6	25	30
	Total	**118.7**	**7122**	**16.93**	**-1**	**4.2**	**5.1**	**-17**	**71**	**86**
2	Gym1	105.5	6330	15.05	-1	4.2	5.1	-15	63	77
3	Gym2	105.5	6330	15.05	-1	4.2	5.1	-15	63	77
4	Hall1	58.0	3480	8.27	-1	4.2	5.1	-8	35	42
	Hall2	0.0	0	0.00	-1	4.2	5.1	0	0	0
	Total	**58.0**	**3480**	**8.27**	**-1**	**4.2**	**5.1**	**-8**	**35**	**42**
5	Staff Bathroom	0.0	0	0.00	-1	4.2	5.1	0	0	0
	Staff Planning	0.0	0	0.00	-1	4.2	5.1	0	0	0
	Music Storage	0.0	0	0.00	-1	4.2	5.1	0	0	0
	Total	**0.0**	**0**	**0.00**	**-1**	**4.2**	**5.1**	**0**	**0**	**0**
6	Music Room	0.0	0	0.00	-1	4.2	5.1	0	0	0
7	Art room	49.0	2940	6.99	-1	4.2	5.1	-7	29	36
	Art Storage	28.0	1680	3.99	-1	4.2	5.1	-4	17	20
	Tech Office	0.0	0	0.00	-1	4.2	5.1	0	0	0
	Boys room	11.0	660	1.57	-1	4.2	5.1	-2	7	8
	Girls room	12.0	720	1.71	-1	4.2	5.1	-2	7	9
	Total	**100.0**	**6000**	**14.26**	**-1**	**4.2**	**5.1**	**-14**	**60**	**73**
All	All Rooms	487.7	29262	69.55	-1	4.2	5.1	-109	458	556

Thermal Conduction Through the Walls and Roofs:

The conduction occurs when there is a temperature difference over a medium. In the morning, the outside air is cooler than that is in the rooms. Thus indoor air loses its energy though walls and roofs. In comparison, the higher temperature at outside during daytime causes energy to move into the rooms. Since the building has good insulation, heat gains from conductions are low. The thermal conductions between rooms are neglected since the temperatures in all rooms will be maintained at the same.

The calculations of the thermal resistance of walls and roofs in different constructions are describes as below. The values of thermal resistances are referred from McQuiston's "*Heating, Ventilating, and Air Conditioning, Fifth Edition*", table 5-1a (P.127) for building materials, and 5-2a (P.135) for air.

Walls:

1. Type A (1): (with 15mph wind)
   a. Component:
      i. Outdoor; Moving Air @15mph; $R = 0.17$ (hr-ft^2-°F/Btu)
      ii. Wall;
         1. 3.625in. Face Brick; $R = 0.44$ (hr-ft^2-°F/Btu)
         2. 2in. R19 BATT Insulation; $R = 12.0$ (hr-ft^2-°F/Btu)
         3. 0.75in. Gypsum Board; $R = 0.14$ (hr-ft^2-°F/Btu)
         4. 7.625in. Concrete; $R = 5.00$ (hr-ft^2-°F/Btu)
         5. 0.625in. Gypsum Board; $R = 0.11$ (hr-ft^2-°F/Btu)
      iii. Indoor Air; Still Air, vertical surface with horizontal heat flow; $R = 0.68$ (hr-ft^2-°F/Btu)
   b. Total Thermal Resistance **$R = 18.54$ (hr-ft^2-°F/Btu)**

2. Type A (2): (with 7.5 mph wind)
   a. Component:
      i. Outdoor; Moving Air @7.5mph; $R = 0.28$ (hr-ft^2-°F/Btu)
      ii. Wall;
         1. 3.625in. Face Brick; $R = 0.44$ (hr-ft^2-°F/Btu)
         2. 2in. R19 BATT Insulation; $R = 12.0$ (hr-ft^2-°F/Btu)
         3. 0.75in. Gypsum Board; $R = 0.14$ (hr-ft^2-°F/Btu)
         4. 7.625in. Concrete; $R = 5.00$ (hr-ft^2-°F/Btu)
         5. 0.625in. Gypsum Board; $R = 0.11$ (hr-ft^2-°F/Btu)
      iii. Indoor Air; Still Air, vertical surface with horizontal heat flow; $R = 0.68$ (hr-ft^2-°F/Btu)
   b. Total Thermal Resistance **$R = 18.43$ (hr-ft^2-°F/Btu)**

3. Type B; (Used in Gymnasium Walls)
    a. Construction:
        i. Outdoor; Moving Air @15mph; R = 0.28 (hr-ft^2-°F/Btu)
        ii. Wall;
            1. 3.625in. Face Brick; R = 0.44 (hr-ft^2-°F/Btu)
            2. 2in. Rigid Insulation; R = 12.0 (hr-ft^2-°F/Btu)
            3. 0.75in. Gypsum Board; R = 0.68 (hr-ft^2-°F/Btu)
            4. 11.625in Concrete; R = 5.8 (hr-ft^2-°F/Btu)
        iii. Indoor Air; Still Air, vertical surface with horizontal heat flow; R = 0.68 (hr-ft^2-°F/Btu)
    b. Total Thermal Resistance R = **19.84 (hr-ft^2-°F/Btu)**

4. Type C: (Used in Hallway Wall)
    a. Composition:
        i. Outdoor; Moving Air @15mph; R = 0.28 (hr-ft^2-°F/Btu)
        ii. Wall;
            1. 3.625in. Face Brick; R = 0.44 (hr-ft^2-°F/Btu)
            2. 2in. R19 BATT Insulation; R = 12.0 (hr-ft^2-°F/Btu)
            3. 0.75in. Gypsum Board; R = 0.68 (hr-ft^2-°F/Btu)
            4. 7.625in. Concrete; R = 5.00 (hr-ft^2-°F/Btu)
        iii. Indoor Air; Still Air, vertical surface with horizontal heat flow; R = 0.68 (hr-ft^2-°F/Btu)
    b. Total Thermal Resistance R = **18.12 (hr-ft^2-°F/Btu)**

Roofs:

5. Type A:
    a. Composition:
        i. Outdoor; Moving Air @15mph; R = 0.17 (hr-ft^2-°F/Btu)
        ii. Roofing;
            1. 0.5in. Cover; R = 0.33 (hr-ft^2-°F/Btu)
            2. 4in. Rigid Insulation; R = 24 (hr-ft^2-°F/Btu)
            3. 1in. Gypsum Board; R = 0.93 (hr-ft^2-°F/Btu)
            4. 1.5in. Metal Deck; R = 0.56 (hr-ft^2-°F/Btu)
            5. 0.5in. Acoustic Board; R = 2.94 (hr-ft^2-°F/Btu)
        iii. Indoor Air; Still Air, horizontal surface with upward heat flow; R = 0.61 (hr-ft^2-°F/Btu)
    b. Total Thermal Resistance R = **29.54(hr-ft^2-°F/Btu)**

6. Type B: (Used for Gymnasium roof)
   a. Construction:
      i. Outdoor; Moving Air @15mph; R = 0.17 (hr-ft^2-°F/Btu)
      ii. Roofing;
         1. 0.5in. Cover; R = 0.33 (hr-ft^2-°F/Btu)
         2. 4in. Rigid Insulation; R = 24 (hr-ft^2-°F/Btu)
         3. 1.5in. Metal Deck; R = 0.56 (hr-ft^2-°F/Btu)
      iii. Indoor Air; Still Air, horizontal surface with upward heat flow; R = 0.61 (hr-ft^2-°F/Btu)
   b. Total Thermal Resistance R = **25.67 (hr-ft^2-°F/Btu)**

By knowing the indoor and outdoor temperatures, and the area of the walls and roofs, the amount of heat transfer can be determined.

Table A-5a: Table of Heat Transfer Through the Walls

Location:		Direction:	Type:	A_{wall} (ft^2)	Temp.(F)				R (hr-ft^2-F/Btu)			Q (Btu/hr)		
Zone:	Room:				M	N	E	R	Wall	$Air_{outdoor}$	Air_{indoor}	M	N	E
1	Kitchen	S	A	270	66	80	85	73	17.58	0.28	0.68	-102	102	175
		W	A	252	66	80	85	73	17.58	0.17	0.68	-96	96	164
	Vestibule	W	A	81	66	80	85	73	17.58	0.17	0.68	-31	31	53
	Maint. Strg.	W	A	243	66	80	85	73	17.58	0.17	0.68	-92	92	158
	P.E. Strg. Room	W	A	144	66	80	85	73	17.58	0.17	0.68	-55	55	94
		N	A	270	66	80	85	73	17.58	0.28	0.68	-102	102	175
2	Gym 1	S	B	1426	66	80	85	73	18.88	0.28	0.68	-503	503	863
3	Gym 2	N	B	1426	66	80	85	73	18.88	0.28	0.68	-503	503	863
4	Hallway 1	W	C	288	66	80	85	73	5.80	0.28	0.68	-298	298	511
		N	A	90	66	80	85	73	17.58	0.28	0.68	-34	34	58
	Hallway 2	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Staff Restroom	-	-	-	-	-	-	-	-	-	-	-	-	-
	Staff Planning	-	-	-	-	-	-	-	-	-	-	-	-	-
	Music Strg.	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Music Room	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Art	N	A	360	66	80	85	73	17.58	0.28	0.68	-136	136	233
	Art Strg. Room	N	A	171	66	80	85	73	17.58	0.28	0.68	-65	65	111
		NE	A	126	66	80	85	73	17.58	0.28	0.68	-48	48	82
	Boys Restroom	NE	A	117	66	80	85	73	17.58	0.28	0.68	-44	44	76
	Girls Restroom	NE	A	117	66	80	85	73	17.58	0.28	0.68	-44	44	76

Table A-5b: Table of Heat Transfer Though the Roofs

Location:		Direction:	Type:	A_{roof} (ft^2)	Temp. (F)				R (hr-ft^2-F/Btu)			Q (Btu/hr)		
Zone:	Room:				M	N	E	R	Roof	$Air_{outdoor}$	Air_{indoor}	M	N	E
1	Kitchen	Roof	A	826	66	80	85	73	28.76	0.17	0.61	-196	196	336
	Vestibule	Roof	A	95	66	80	85	73	28.76	0.17	0.61	-23	23	39
	Maint. Strg.	Roof	A	909	66	80	85	73	28.76	0.17	0.61	-215	215	369
	P.E. Strg.	Roof	A	460	66	80	85	73	28.76	0.17	0.61	-109	109	187
2	Gym 1	Roof	B	2417	66	80	85	73	24.89	0.17	0.61	-659	659	1130
3	Gym 2	Roof	B	2417	66	80	85	73	24.89	0.17	0.61	-659	659	1130
4	Hallway 1	Roof	A	1296	66	80	85	73	28.76	0.17	0.61	-307	307	526
	Hallway 2	Roof	A	842	66	80	85	73	28.76	0.17	0.61	-200	200	342
5	Staff Plan.	Roof	A	780	66	80	85	73	28.76	0.17	0.61	-185	185	317
	Staff Toilet	Roof	A	52	66	80	85	73	28.76	0.17	0.61	-12	12	21
	Music Storage	Roof	A	222	66	80	85	73	28.76	0.17	0.61	-53	53	90
6	Music Room	Roof	A	1165	66	80	85	73	28.76	0.17	0.61	-276	276	473
7	Art Room	Roof	A	1278	66	80	85	73	28.76	0.17	0.61	-303	303	519
	Art Storage Room	Roof	A	388	66	80	85	73	28.76	0.17	0.61	-92	92	158
	Tech Office	Roof	A	105	66	80	85	73	28.76	0.17	0.61	-25	25	43
	Boys Bathroom	Roof	A	266	66	80	85	73	28.76	0.17	0.61	-63	63	108
	Girls Bathroom	Roof	A	266	66	80	85	73	28.76	0.17	0.61	-63	63	108

Heat Transfer Due to the Sun's Radiation:

The radiation from the Sun is another large portion of heat addition so it must be taken into account. Since the south side of the building complex is attached to other part of the school and other sides are also surrounded by nearby buildings, most of the radiations to the walls are neglected. The amount of radiation receiving from the Sun was reduce by 25% in morning and evening since the weather conditions were partly cloudy, and 50% reduction in the noon since it was mostly cloudy. The roofing of the school has ε of 0.1. Here is the calculation to determine the Sun's location and time. The equations of time and its calculation procedure are based on McQuiston's "*Heating, Ventilating, and Air Conditioning, Fifth Edition*", chapter 6, page 160 ~ 168. The declination angle and radiation rate are based on table 6-1 (P. 165)

1. Location of Salina, Kansas: N. 38.80deg. W. 97.65deg.

   EOT = 229.2 (0.000075 + 0.001868*cos*N – 0.032077*sin*N – 0.014615*cos*2N – 0.04089*sin*2N) minutes

   Where,
   N = (n-1)(360/365) n = number of days since Jan. 1st

   The date is September 1, 2001 (n = 272) so, N = 267.2876712

   Equation of Time = 9.789499 min.

2. Declination Angle (δ)

   δ = 0.3963723 - 22.9132745*cos*N + 4.0254304*sin*N - 0.3872050*cos*2N + 0.05196728*sin*2N - 0.1545267*cos*3N + 0.08479777*sin*3N

   Where,
   N = 267.2876712
   δ = 0.0 (September had declination of 0.0 degrees)

	8:00a.m.,	1:00p.m.,	5:00p.m.
CST=CDST-1 hour =	7:00a.m.,	12:00p.m.,	4:00p.m. (at 90deg.W)
LCT=CST- 4x(97.65-90.00)	6:29a.m.,	11:29a.m.,	3:29p.m. (at 97.65deg W.)
LST=LCT+EOT	6:38a.m.,	11:38a.m.,	3:38p.m. (Local Sun Time)
The hour Angle (h)deg	80.75	6.25	-54.25 (0 degrees at noon)
Solar Altitude: β	7.20	50.78	27.09
Zenith angle: ψ	82.80	39.22	62.91
Solar Azimuth angle: Φ	84.17	9.89	1.83
Wall Solar Azimuth: γ	166.97	49.11	64.74 (1)
Angle of Incidence: θ	165.14	65.55	67.67 (Horizontal1)
	82.8	39.22	62.91 (Vertical)

In September, the average radiation of Sun is 360.2 Btu/hr-ft^2 The calculations done according to this value and the heat addition to each room has been tabulated.

Table A-6: Heat Addition to the Rooms due to the Radiation

Location:		A_{roof}(ft^2)	Energy Received (Btu/hr)		
Zone:	Room:		Morning	Noon	Evening
1	Kitchen	826	1466	10698	9012
	Vestibule	95	169	1230	1036
	Maint. Strg.	909	1614	11773	9917
	P.E. Strg.	460	817	5958	5019
2	Gym 1	2417	4291	31304	26369
3	Gym 2	2417	4291	31304	26369
4	Hallway1	1296	2301	16785	14139
	Hallway2	842	1495	10905	9186
5	Staff Planning Room	780	1385	10102	8510
	Staff Restroom	52	92	673	567
	Music Storage Room	222	394	2875	2422
6	Music Room	1165	2068	15089	12710
7	Art Room	1278	2269	16552	13943
	Art Storage Room	388	689	5025	4233
	Tech. Office	105	186	1360	1146
	Boys Bathroom	266	472	3445	2902
	Girls Bathroom	266	472	3445	2902

Detailed Information of the Heat Generated for Different Times

In order to determine the required performance of the air conditioning unit, total cooling load for the each zone must to be known. The values are determined for the hours of analysis, and the original values are from the previous sections.

The zone 1 is consisted of kitchen, vestibule, maintenance and P.E. storage rooms. The kitchen has dining staffs for food preparation in the morning and noon. Most of other rooms will not have people all day, except for a short term.

TableA-7a: Detailed Information of Zone 1

Location		Item	Heat Generated (Btu/hr)			Sensible Heat (Btu/hr)			Latent Heat (Btu/hr)		
Zone	Room		Morning	Noon	Evening	M	N	E	M	N	E
1	Kitchen	32W light (9)	927	927	927	927	927	927	0	0	0
		Adults (4/4/0)	5,800	5,800	0	2,320	2,320	0	3,480	3,480	0
		Children (0/10/0)	0	6,000	0	0	3,300	0	0	2,700	0
		Freezer (2)	3,680	3,680	3,680	3,680	3,680	3,680	0	0	0
		Hot Box (2)	5,380	5,380	0	5,380	5,380	0	0	0	0
		Hot Bar (1)	990	990	0	990	990	0	0	0	0
		Cold Bar (2)	990	990	0	990	990	0	0	0	0
		Beverage Dispenser (1)	2,562	2,562	2,562	2,562	2,562	2,562	0	0	0
		Dish washer (2)	0	190	0	0	190	0	0	0	0
		Infiltration	-6	25	30	-6	12	15	0	12	15
		Wall (Direct)	-198	198	339	-198	198	339	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-196	196	336	-196	196	336	0	0	0
		Roof (Indirect)	1,473	10,769	8,951	1,473	10,769	8,951	0	0	0
		Total	**21,403**	**37,705**	**16,824**	**17,923**	**31,513**	**16,809**	**3,480**	**6,192**	**15**
	Vest	32W light (1)	103	103	0	103	103	0	0	0	0
		Adults (1/1/0)	740	740	0	370	370	0	370	370	0
		Infiltration	-2	9	11	-2	4	5	0	4	5
		Wall (Direct)	-31	31	53	-31	31	53	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-23	23	39	-23	23	39	0	0	0
		Roof (Indirect)	169	1,239	1,029	169	1,239	1,029	0	0	0
		Total	**957**	**2,145**	**1,132**	**587**	**1,770**	**1,127**	**370**	**374**	**5**
	Maint. Strg.	32W lights (10)	1,034	1,034	0	1,034	1,034	0	0	0	0
		Infiltration	-3	13	16	-3	6	8	0	6	8
		Wall (Direct)	-92	92	158	-92	92	158	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-215	215	369	-215	215	369	0	0	0
		Roof (Indirect)	1,621	11,851	9,850	1,621	11,851	9,850	0	0	0
		Total	**2,344**	**13,205**	**10,393**	**2,344**	**13,199**	**10,385**	**0**	**6**	**8**
	P.E. Storage	32W lights (6)	620	620	0	620	620	0	0	0	0
		Adults (4/0/0)	5,800	0	0	2,320	0	0	3,480	0	0
		Infiltration	-6	25	30	-6	12	15	0	12	15
		Wall (Direct)	-157	157	269	-157	157	269	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-109	109	187	-109	109	187	0	0	0
		Roof (Indirect)	820	5,997	4,985	820	5,997	4,985	0	0	0
		Total	**6,969**	**6,908**	**5,470**	**3,489**	**6,895**	**5,455**	**3,480**	**12**	**15**

Zone 2 and 3 are both in the gymnasium. The facility will be used for both exercise and dining. During noon, students will be eating in the gym about 150 students at a time on the average.

Table A-7b: Detailed Information of Zone 2 and 3

Location		Item	Heat Generated (Btu/hr)			Sensible Heat (Btu/hr)			Latent Heat (Btu/hr)		
Zone	Room		Morning	Noon	Evening	M	N	E	M	N	E
2	Gym1	32W lights (6)	620	620	620	620	620	620	0	0	0
		400W lights (6)	9,343	9,343	0	9,343	9,343	0	0	0	0
		Adults (3/0/0)	4,350	0	0	1,740	0	0	2,610	0	0
		Children (0/75/0)	0	30,000	0	0	16,500	0	0	13,500	0
		Infiltration	-15	63	77	-15	32	38	0	32	38
		Wall (Direct)	-503	503	863	-503	503	863	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-659	659	1,130	-659	659	1,130	0	0	0
		Roof (Indirect)	4,310	31,510	26,190	4,310	31,510	26,190	0	0	0
		Total	**17,446**	**72,700**	**28,880**	**14,836**	**59,168**	**28,842**	**2,610**	**13,532**	**38**
3	Gym2	32W lights (6)	620	620	620	620	620	620	0	0	0
		400W lights (6)	9,343	9,343	0	9,343	9,343	0	0	0	0
		Adults (3/0/0)	4,350	0	0	1,740	0	0	2,610	0	0
		Children (0/75/0)	0	30,000	0	0	16,500	0	0	13,500	0
		Infiltration	-15	63	77	-15	32	38	0	32	38
		Wall (Direct)	-503	503	863	-503	503	863	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-659	659	1,130	-659	659	1,130	0	0	0
		Roof (Indirect)	4,310	31,510	26,190	4,310	31,510	26,190	0	0	0
		Total	**17,446**	**72,700**	**28,880**	**14,836**	**59,168**	**28,842**	**2,610**	**13,532**	**38**

The both hallways are considered as one zone since they are connected with open space. In the morning and evening, there will be no student in the building. During the noon, about 10 ~ 30 people are walking on the hallways on the average.

Table A-7c: Detailed Information of Zone 4

Location		Item	Heat Generated (Btu/hr)			Sensible Heat (Btu/hr)			Latent Heat (Btu/hr)		
Zone	Room		Morning	Noon	Evening	M	N	E	M	N	E
4	Hall1	32W lights (10)	1,034	1,034	1,034	1,034	1,034	1,034	0	0	0
		Adults (3/3/2)	2,220	2,220	1,480	1,110	1,110	740	1,110	1,110	740
		Children (0/7/0)	0	4,200	0	0	2,100	0	0	2,100	0
		Infiltration	-8	35	42	-8	17	21	0	17	21
		Wall (Direct)	-332	332	569	-332	332	569	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-307	307	526	-307	307	526	0	0	0
		Roof (Indirect)	2,311	16,896	14,043	2,311	16,896	14,043	0	0	0
		Total	**4,917**	**25,024**	**17,696**	**3,807**	**21,797**	**16,934**	**1,110**	**3,227**	**761**
	Hall2	32W lights (9)	990	990	990	990	990	990	0	0	0
		Adults (3/3/3)	2,220	2,220	2,220	1,110	1,110	1,110	1,110	1,110	1,110
		Children (0/7/0)	0	4,200	0	0	2,100	0	0	2,100	0
		Infiltration	0	0	0	0	0	0	0	0	0
		Wall (Direct)	0	0	0	0	0	0	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-200	200	342	-200	200	342	0	0	0
		Roof (Indirect)	1,501	10,977	9,124	1,501	10,977	9,124	0	0	0
		Total	**4,512**	**18,587**	**12,676**	**3,402**	**15,377**	**11,566**	**1,110**	**3,210**	**1,110**

For zone 5, the air conditioning unit providing air to the staff restroom and planning room, and also music storage room. Very low heat generations are expected over the day.

Table A-7d: Detailed Information of Zone 5

Location			Heat Generated (Btu/hr)			Sensible Heat (Btu/hr)			Latent Heat (Btu/hr)		
Zone	Room	Item	Morning	Noon	Evening	M	N	E	M	N	E
5	Staff Restroom	32W lights (2)	220	220	220	220	220	220	0	0	0
		Hand Dryer (1)	1,366	1,366	0	1,366	1,366	0	0	0	0
		Adult (1/1/0)	740	740	0	370	370	0	370	370	0
		Infiltration	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-12	12	21	-12	12	21	0	0	0
		Roof (Indirect)	93	678	563	93	678	563	0	0	0
		Total	**2,406**	**3,016**	**805**	**2,036**	**2,646**	**805**	**370**	**370**	**0**
	Staff Planning Room	32W lights (9)	990	990	0	990	990	0	0	0	0
		Adults (10/15/0)	5,900	8,850	0	3,245	4,868	0	2,655	3,983	0
		Infiltration	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-185	185	317	-185	185	317	0	0	0
		Roof (Indirect)	1,391	10,169	8,452	1,391	10,169	8,452	0	0	0
		Total	**8,096**	**20,194**	**8,769**	**5,441**	**16,211**	**8,769**	**2,655**	**3,983**	**0**
	Music Storage Room	32W lights (3)	330	330	330	330	330	330	0	0	0
		Infiltration	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-53	53	90	-53	53	90	0	0	0
		Roof (Indirect)	396	4,341	2,406	396	4,341	2,406	0	0	0
		Total	**673**	**4,724**	**2,826**	**673**	**4,724**	**2,826**	**0**	**0**	**0**

The zone 6 is for music room only. The music instruments need to be maintained under specific condition. The room will be used during the noon.

Table A-7e: Detained Information of Zone 6

Location			Heat Generated (Btu/hr)			Sensible Heat (Btu/hr)			Latent Heat (Btu/hr)		
Zone	Room	Item	Morning	Noon	Evening	M	N	E	M	N	E
6	Music Room	32W lights (15)	1,650	1,650	1,650	1,650	1,650	1,650	0	0	0
		Adults (0/1/0)	0	445	0	0	267	0	0	178	0
		Children (0/20/0)	0	7,200	0	0	4,320	0	0	2,880	0
		Computers (5)	6,830	6,830	0	6,830	6,830	0	0	0	0
		Infiltration	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-276	276	473	-276	276	473	0	0	0
		Roof (Indirect)	2,077	22,782	12,624	2,077	22,782	12,624	0	0	0
		Total	**10,281**	**39,183**	**14,747**	**10,281**	**36,125**	**14,747**	**0**	**3,058**	**0**

This zone covers most of the east side of the building. Art room will be occupied during the noon, and tech office will be staffed most of the day. Both restrooms are expected to be occupied largely during the noon hour.

Table A-7f: Detailed Information of Zone 7

Location			Heat Generated (Btu/hr)			Sensible Heat (Btu/hr)			Latent Heat (Btu/hr)		
Zone	Room	Item	Morning	Noon	Evening	M	N	E	M	N	E
7	Art room	32W lights (15)	1,650	1,650	1,650	1,650	1,650	1,650	0	0	0
		26W lights (2)	180	180	180	180	180	180	0	0	0
		Adults (0/1/0)	0	445	0	0	267	0	0	178	0
		Children (0/20/0)	0	7,200	0	0	4,320	0	0	2,880	0
		Computers (5)	6,830	6,830	0	6,830	6,830	0	0	0	0
		Infiltrations	-7	29	36	-7	15	18	0	15	18
		Wall (Direct)	-136	136	233	-136	136	233	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-303	303	519	-303	303	519	0	0	0
		Roof (Indirect)	2,279	16,661	13,848	2,279	16,661	13,848	0	0	0
		Total	**10,493**	**33,434**	**16,466**	**10,493**	**30,362**	**16,448**	**0**	**3,073**	**18**
	Art Strg. Room	32W lights (3)	330	330	0	330	330	0	0	0	0
		Infiltration	-4	17	20	-4	8	10	0	8	10
		Wall (Direct)	-112	113	193	-112	113	193	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-92	92	158	-92	92	158	0	0	0
		Roof (Indirect)	692	5,058	4,204	692	5,058	4,204	0	0	0
		Total	**814**	**5,610**	**4,575**	**814**	**5,602**	**4,565**	**0**	**8**	**10**
	Tech Office	32W lights (2)	220	220	220	220	220	220	0	0	0
		Adults (1/1/0)	590	590	0	325	325	0	266	266	0
		Infiltration	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-25	25	43	-25	25	43	0	0	0
		Roof (Indirect)	187	2,053	1,138	187	2,053	1,138	0	0	0
		Total	**972**	**2,888**	**1,400**	**707**	**2,623**	**1,400**	**266**	**266**	**0**
	Boys room	32W lights (3)	330	330	0	330	330	0	0	0	0
		Hand Dryer (1)	0	1,366	0	0	1,366	0	0	0	0
		Children (0/3/0)	0	1,800	0	0	900	0	0	900	0
		Infiltration	-2	7	8	-2	3	4	0	3	4
		Wall (Direct)	-44	44	76	-44	44	76	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-63	63	108	-63	63	108	0	0	0
		Roof (Indirect)	474	3,468	2,882	474	3,468	2,882	0	0	0
		Total	**696**	**7,078**	**3,074**	**696**	**6,174**	**3,070**	**0**	**903**	**4**
	Girls room	32W lights (4)	440	440	0	440	440	0	0	0	0
		Hand Dryer (1)	0	1,366	0	0	1,366	0	0	0	0
		Children (0/3/0)	0	1,800	0	0	900	0	0	900	0
		Infiltration	-2	7	9	-2	4	4	0	4	4
		Wall (Direct)	-44	44	76	-44	44	76	0	0	0
		Wall (Indirect)	0	0	0	0	0	0	0	0	0
		Roof (Direct)	-63	63	108	-63	63	108	0	0	0
		Roof (Indirect)	474	3,468	2,882	474	3,468	2,882	0	0	0
		Total	**805**	**7,188**	**3,075**	**805**	**6,285**	**3,070**	**0**	**904**	**4**

Summary of the Cooling Load

By adding the all heat generated / added by occupants, appliances, infiltration, conduction and radiation, the cooling loads for each room and zone can be summarized.

Table A-8: Summary of the Cooling Load

Location:		Heat Generated (Btu/hr)			Sensible Heat (Btu/hr)			Latent Heat (Btu/hr)		
Zone	Room	Morning	Noon	Evening	Morning	Noon	Evening	Morning	Noon	Evening
1	Kitchen	21,403	37,705	16,824	17,923	31,513	16,809	3,480	6,192	15
	Vest	957	2,145	1,132	587	1,770	1,127	370	374	5
	Maintenance	2,344	13,205	10,393	2,344	13,199	10,385	0	6	8
	P.E. Storage	6,969	6,908	5,470	3,489	6,895	5,455	3,480	12	15
	Total	**31,673**	**59,963**	**33,819**	**24,343**	**53,378**	**33,775**	**7,330**	**6,586**	**43**
2	Gym1	17,446	72,700	28,880	14,836	59,168	28,842	2,610	13,532	38
3	Gym2	17,446	72,700	28,880	14,836	59,168	28,842	2,610	13,532	38
4	Hallway1	4,917	25,024	17,696	3,807	21,797	16,934	1,110	3,227	761
	Hallway2	4,512	18,587	12,676	3,402	15,377	11,566	1,110	3,210	1,110
	Total	**9,429**	**43,611**	**30,371**	**7,209**	**37,173**	**28,500**	**2,220**	**6,437**	**1,871**
5	Staff Restroom	2,406	3,016	805	2,036	2,646	805	370	370	0
	Staff Planning	8,096	20,194	8,769	5,441	16,211	8,769	2,655	3,983	0
	Music Storage	673	4,724	2,826	673	4,724	2,826	0	0	0
	Total	**11,176**	**27,934**	**12,399**	**8,151**	**23,581**	**12,399**	**3,025**	**4,353**	**0**
6	Music Room	10,281	39,183	14,747	10,281	36,125	14,747	0	3,058	0
7	Art room	10,493	33,434	16,466	10,493	30,362	16,448	0	3,073	18
	Art Storage	814	5,610	4,575	814	5,602	4,565	0	8	10
	Tech Office	972	2,888	1,400	707	2,623	1,400	266	266	0
	Boys room	696	7,078	3,074	696	6,174	3,070	0	903	4
	Girls room	805	7,188	3,075	805	6,285	3,070	0	904	4
	Total	**13,780**	**56,199**	**28,591**	**13,515**	**51,045**	**28,554**	**266**	**5,153**	**36**
All	**All Area**	**111,231**	**372,289**	**177,687**	**93,171**	**319,639**	**175,660**	**18,061**	**52,650**	**2,027**

Air Circulation and the Selection of the Unit:

Certain amount of air must be delivered to each room in order to maintain the room temperature and moisture level. In addition, enforcing the health regulations regarding to fresh air requirement set by the government is also an important factor.

Fresh Air Requirement:

For different conditions of the room, there are certain amount of air which have to be replaced with outside air. The designed system must be able to deliver enough fresh air to each room in the zone. These numbers must be balanced carefully since too much fresh air drive the operation cost up, and lower amount of air can causes health problem to the occupants. For this project, the amount of fresh air should not exceed more than 50%, except for the gym where has fresh air ratio of 80%, simply because of very high level of activity is expected. Also for the restrooms, re-circulation of air is not recommended. The number of the occupants on the determined from averaged number of the people who are in the rooms.

Table A-9: Chart of Fresh Air Requirement for Each Room

Zone	Room	A (ft^2)	Vol. (ft^3)	Air Requirement		# of Occupants						Fresh Air Needed (cfm)		
				Value	Unit	M		N		E		M	N	E
1	Kitchen	826	7434	30	cfm/occu.	4		14	T	0		120	420	0
	Vest	95	855	1	cfm/ft^2	1	T/O	1	T/O	0		95	95	95
	Maint. Strg.	909	8181	0.33	cfm/ft^2	0		0		0		300	300	300
	P.E. Strg.	460	4140	0.33	cfm/ft^2	4	T	0		0		152	152	152
	Total											**667**	**967**	**547**
2	Gym1	2417	55591	50	cfm/occu.	3		75	T	0		150	3750	0
3	Gym2	2417	55591	50	cfm/occu.	3		75	T	0		150	3750	0
4	Hall1	1296	11664	0.33	cfm/ft^2	3		10		2		428	428	428
	Hall2	842	7578	0.33	cfm/ft^2	3		10		3		278	278	278
	Total											**706**	**706**	**706**
5	Staff Bath	52	468	43	cfm/toilet	1	T	1	T	0		43	43	43
	Staff Planning	780	7020	20	cfm/occu.	10	T	15	T	0		200	300	0
	Music Strg.	222	1998	1	cfm/ft^2	0		0		0		222	222	222
	Total											**465**	**565**	**265**
6	Music	1165	10485	20	cfm/occu.	0		21		0		0	420	0
7	Art Room	1278	11502	20	cfm/occu.	0		21		0		0	420	0
	Art Strg.	388	3492	1	cfm/ft^2	0		0		0		388	388	388
	Tech Office	105	945	20	cfm/occu.	1		1		0		20	20	0
	Boys room	266	2394	30	cfm/occu	0		3	T	0		90	90	90
	Girls room	266	2394	35	cfm/toilet	0		3	T	0		90	90	90
	Total											**588**	**1008**	**568**

T indicates traffic, and T/O is for traffic to the outside

Ratio of the fresh air

In order to satisfy the fresh air requirement, the combination of the fresh and returned air must be carefully determined. Once the percentage of fresh air for the unit is chosen, it is not possible to change the ratio by the room, thus the air volume delivered to each room must satisfy both air supply and fresh air requirement at design phase. The unit is allowed to have fresh air ratio of between 20 to 50% to maintain low operating cost, except for the gymnasium where high level of activities are expected. The fresh air ratios for the zones are chosen based on the considerations above.

Table A-10: Air Supply / Fresh Air Ratio for Zones

Location:		Capacity	Air_{Supply}	Air_{Fresh}	
Zone	Room	(ton)	(cfm)	(cfm)	$\%Air_{Fresh}$
1	Kitchen		*1,904*	*420*	*22%*
	Vest		*190*	*95*	*50%*
	Maintenance		*667*	*300*	*45%*
	P.E. Storage		*352*	*152*	*43%*
	Total	**5**	**3,100**		**50%**
2	Gym1	**6**	**4,700**	*3750*	**80%**
3	Gym2	**6**	**4,700**	*3750*	**80%**
4	Hallway1		*1,426*	*428*	*30%*
	Hallway2		*939*	*278*	*30%*
	Total	**4**	**2,365**		**30%**
5	Staff Restroom		*152*	*43*	*28%*
	Staff Planning Room		*1,020*	*300*	*29%*
	Music Storage		*444*	*222*	*50%*
	Total	**2**	**1,616**		**50%**
6	Music Room	**3**	**1,979**	*420*	**21%**
7	Art room		*1,689*	*420*	*25%*
	Art Storage		*776*	*388*	*50%*
	Tech Office		*146*	*20*	*14%*
	Boys room		*200*	*100*	*50%*
	Girls room		*200*	*100*	*50%*
	Total	**5**	**3,011**	*1028*	**50%**
All	**All Area**	**31**	**18,802**		

Selection of the Air Conditioning Unit

The units for the each zone were selected based on the cooling capacity and the ability of airflow delivery rate required. To determine the cooling load, table A-8 was used and for the air supply, table A-10 was used as reference. Refer making on the plan "RTU" with a number for each zone.

Table A-11: Marking on the plan and the Unit Information

Mark	Capacity (ton)	Air_{Supply} (cfm)	Model#
RTU1	5	3,100	L6A060
RTU2	6	4,700	L6A100
RTU3	6	4,700	L6A100
RTU4	4	2,365	L6A048
RTU5	2	1,616	L6A036
RTU6	3	1,979	L6A036
RTU7	4	3,011	L6A060

Notes:

1. Job site elevation is 1,300ft.
2. External Static Pressure includes economizer and 0.5$in._{W.G.}$ for dirty filter.
3. Provide manufactures recommended service clearance around entire unit.
4. Heating and Cooling capacities and fan static pressures are at jobsite altitude.
5. Provide 2in., 30% efficient filters.
6. Provide full perimeter roof curb.
7. Unit to have single point electrical connection.
8. Provide factory installed non-fused disconnect.
9. Provide with thru the base electrical connection.

The information of the air conditioning units are available on the back of this report.

Estimate of Cost of the HVAC system:

1. Duct work

Type	in^3 of ductwork	Cost/lb	Total Cost
Medium Pressure	8310	3.57*	24699**

*Price sheet is attached to document

**Costs include fabrication, field assembly, labor and installation per pound of duct installed

2. Fans

Exhaust Size	# of units	inlet size	Labor/unit	Cost
250 cfm	2	8"x8"	$ 90.00	$ 500.00
1200 cfm	1	12"x12"	$ 90.00	$ 300.00

3. Rooftop Units

Zone	Rooftop type	# of units	cfm	Unit Cost	Labor	Total Cost
1	Single Zone	1	3100	$3,500.00	$ 450.00	$5,500.00
2	Single Zone	1	4700	$6,100.00	$ 500.00	$7,000.00
3	Single Zone	1	4700	$6,100.00	$ 500.00	$7,000.00
4	Single Zone	1	2365	$3,100.00	$ 450.00	$3,550.00
5	Single Zone	1	1616	$2,800.00	$ 450.00	$4,800.00
6	Single Zone	1	1979	$3,000.00	$ 450.00	$5,000.00
7	Single Zone	1	3011	$3,200.00	$ 450.00	$5,200.00

4. Fire Dumpers

# of units	Gauge	Labor	Unit Cost	Total Cost
6	14	12.20/ea	$ 26.20	$ 230.40

5. Grills and Diffusers

Type	# of Units	Unit Costs	Size	Equipment/unit	Labor/unit	Total Cost
Supply	35	80	24"x24"	$ 0.14	$ 8.30	$3,095.40
Return	10	48	24"x24"	$ 0.14	$ 14.30	$ 624.40
Gym	8	40.9	18"x8"	$ 0.14	$ 8.30	$ 394.72

6. Filters

Type	# of Units	Unit Costs	Equipment	Labor/unit	Total Cost
99.99% Efficiency	7	$ 262.00	$ 0.88	$ 51.50	$2,200.66

7. Turning Valves

Type	# of Units	Unit Costs	Equipment	Labor/unit	Total
Elbow	5	$ 5.60	$ 0.02	$ 1.68	$ 36.50

8. Cost
   a. Total Cost $70,131.08
   b. Multiplier for construction x1.5
   c. Total Estimated Construction Costs **$105,196.60**
   d. Building Estimated Construction Costs $8,000,000
   e. HVAC design Estimation Cost **$80,000**

Heavy Duty Gym Grilles
90 / 91 / 95 / 96 Series

Product Information

Heavy Gauge Steel Models

3/8" (10) Blade Spacing, 0° Deflection
Grille **90**
Register w/ Steel Damper **90D**
3/8" (10) Blade Spacing, 45° Deflection
Grille **91**
Register w/ Steel Damper **91D**
3/4" (19) Blade Spacing, 0° Deflection
Grille **95**
Register w/ Steel Damper **95D**
3/4" (19) Blade Spacing, 45° Deflection
Grille **96**
Register w/ Steel Damper **96D**

Application:
- Specifically designed for severe applications such as gymnasiums, factories, warehouses, public washrooms, heavy traffic corridors and any general public area.

Construction:
- 4 Core styles available of heavy 14 gauge steel.
- Heavy gauge 1 1/4" (32) flat steel border. Smooth contours reduce the possibility of injury to athletes when used in a gymnasium.
- Optional opposed blade damper in steel construction with black finish.

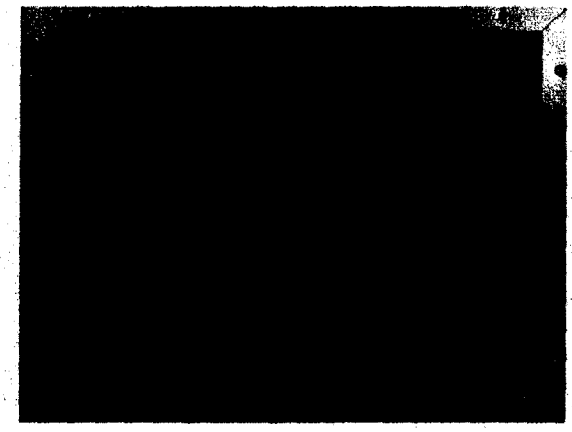
Mounting / Finish Options

Blade Orientation
Blades parallel to Long Dimension **L**
Blades parallel to Short Dimension **S**
Optional Mounting Frame **D**
Fastening
Counter sunk screwholes c/w oval-head screws **A**
Concealed (n/a on Model 91) **C**
Finish
White **B12**
Optional finishes – contact Price representative. **SPL**

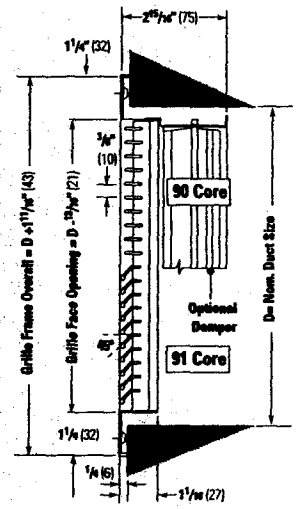
Available Sizes

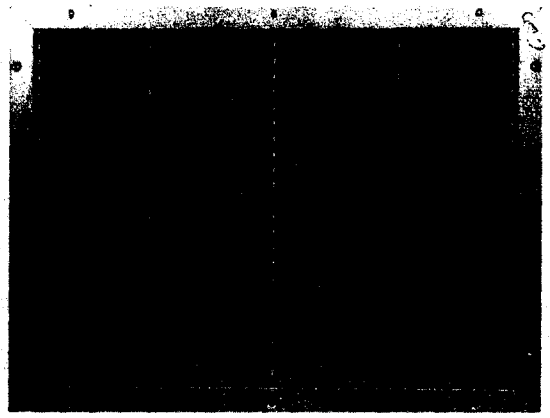
Minimum	Maximum*
6" x 4" (152 x 102)	48" x 48" (1219 x 1219)

* One piece

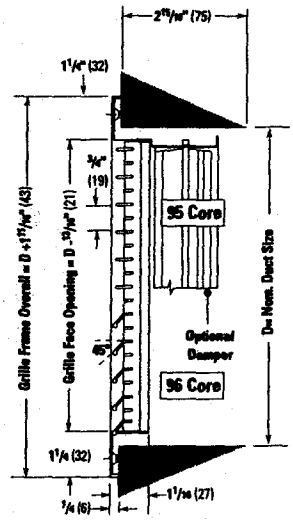


Model 91





Model 96



✓ Product Selection Checklist

1] Select Unit Size based on desired performance characteristics.
2] Select Outlet type by model number (Core style, damper).
3] Select Blade Orientation.
4] Select Mounting Frame if desired.
5] Select Fastening type (**A** is standard).
6] Select Finish.
Example: 24" x 24" / 95D / L / A / B12

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimetre.

Heavy Duty Gym Grilles
90 Series

price®

Performance Data

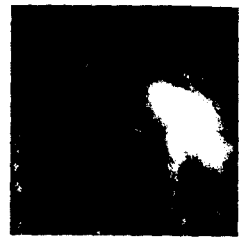
Core Area Sq. Ft.	Nominal Size				Core Velocity / Velocity Pressure / Negative SP	400 .010 .024	500 .016 .038	600 .022 .052	700 .031 .074	800 .040 .095	900 .050 .119	1000 .062 .147	1100 .075 .178	1200 .090 .213	1400 .122 .289
								NC 20		30			40		
	7 x 4				CFM	60	75	90	105	120	135	150	165	180	210
.15	6 x 5				NC	—	—	20	25	29	33	37	40	43	48
	8 x 4	6 x 6			CFM	72	90	108	126	144	162	180	198	216	252
.18	7 x 5				NC	—	—	20	25	29	33	37	40	43	48
	10 x 4	7 x 6			CFM	88	110	132	154	176	198	220	242	264	308
.22	8 x 5				NC	—	15	21	26	30	34	38	41	44	49
	12 x 4	8 x 6			CFM	104	130	156	182	208	234	260	286	312	364
.26	10 x 5				NC	—	15	21	26	31	35	38	41	44	50
	14 x 4				CFM	120	150	180	210	240	270	300	330	360	420
.30					NC	—	15	21	27	31	35	39	42	45	50
	16 x 4	10 x 6			CFM	136	170	204	238	272	306	340	374	408	476
.34	12 x 5				NC	—	15	22	27	31	35	39	42	45	50
	18 x 4	12 x 6			CFM	156	195	234	273	312	351	390	429	468	546
.39	14 x 5	8 x 8			NC	—	16	22	27	31	35	39	42	45	50
	20 x 4	14 x 6			CFM	184	230	276	322	368	414	460	506	552	644
.46	16 x 5	10 x 8			NC	—	17	23	28	32	36	40	43	46	51
	24 x 4	16 x 6			CFM	208	260	312	364	416	468	520	572	624	728
.52	18 x 5				NC	—	17	23	28	32	36	40	43	46	51
	28 x 4	18 x 6	10 x 10		CFM	240	300	360	420	480	540	600	660	720	840
.60	20 x 5	12 x 8			NC	—	18	24	29	33	37	41	44	47	52
	30 x 4	20 x 6	12 x 10		CFM	276	345	414	483	552	621	690	759	828	966
.69	24 x 5	14 x 8			NC	—	18	24	29	33	37	41	44	47	52
	36 x 4	22 x 6	14 x 10		CFM	324	405	486	567	648	729	810	891	972	1134
.81	28 x 5	16 x 8			NC	—	18	24	29	33	37	41	44	47	52
	40 x 4	26 x 6	16 x 10		CFM	360	450	540	630	720	810	900	990	1080	1260
.90	30 x 5	18 x 8	12 x 12		NC	—	19	25	30	34	38	42	45	48	53
	48 x 4	30 x 6	14 x 12		CFM	428	535	642	749	856	963	1070	1177	1284	1498
1.07	36 x 5	18 x 10			NC	—	19	25	30	34	38	42	45	48	53
	34 x 6	20 x 10	14 x 14		CFM	472	590	708	826	944	1062	1180	1298	1416	1652
1.18	24 x 8	16 x 12			NC	—	19	25	30	34	38	42	45	48	53
	60 x 4	36 x 6	16 x 14		CFM	536	670	804	938	1072	1206	1340	1474	1608	1876
1.34	48 x 5	18 x 12			NC	—	20	26	31	35	39	43	46	49	54
	72 x 4	24 x 10	18 x 14		CFM	640	800	960	1120	1280	1440	1600	1760	1920	2240
1.60	30 x 8	22 x 12	16 x 16		NC	—	20	26	31	35	39	43	46	49	54
	60 x 5	36 x 8	24 x 12	18 x 16	CFM	720	900	1080	1260	1440	1620	1800	1980	2160	2520
1.80	48 x 6	30 x 10	20 x 14		NC	—	21	27	32	36	40	44	47	50	55
	72 x 5	40 x 8	30 x 12	20 x 16	CFM	832	1040	1248	1456	1664	1872	2080	2288	2496	2912
2.08	60 x 6	36 x 10	24 x 14	18 x 18	NC	—	21	27	32	36	40	44	47	50	55
	72 x 6	32 x 12	24 x 16		CFM	980	1225	1470	1715	1960	2205	2450	2695	2940	3430
2.45	48 x 8	26 x 14	20 x 18		NC	—	22	28	33	37	41	45	48	51	56
	36 x 12	26 x 16	22 x 20		CFM	1112	1390	1668	1946	2224	2502	2780	3058	3336	3892
2.78	30 x 14	24 x 18			NC	—	22	28	33	37	41	45	48	51	56
	60 x 8	40 x 12	30 x 16	24 x 20	CFM	1244	1555	1866	2177	2488	2799	3110	3421	3732	4354
3.11	48 x 10	36 x 14	26 x 18		NC	—	22	28	33	37	41	45	48	51	56
	72 x 8	48 x 12	30 x 18		CFM	1444	1805	2166	2527	2888	3249	3610	3971	4332	5054
3.61	60 x 10	36 x 16	24 x 24		NC	15	23	29	34	38	42	46	49	52	57
	48 x 14	32 x 20			CFM	1716	2145	2574	3003	3432	3861	4290	4719	5148	6006
4.29	36 x 18	28 x 24			NC	15	23	29	34	38	42	46	49	52	57
	72 x 10	36 x 20			CFM	1860	2325	2790	3255	3720	4185	4650	5115	5580	6510
4.65	48 x 16	30 x 24			NC	15	23	29	34	38	42	46	49	52	57
	72 x 12	48 x 18			CFM	2232	2790	3348	3906	4464	5022	5580	6138	6696	7812
5.58	60 x 14	36 x 24			NC	16	24	30	35	39	43	47	50	53	58
	72 x 14	48 x 20			CFM	2500	3125	3750	4375	5000	5625	6250	6875	7500	8750
6.25	60 x 16	30 x 30			NC	16	24	30	35	39	43	47	50	53	58
							NC 20		30		40			50	

Performance Notes:

1. Tested in accordance with ASHRAE Standard 70-1991 "Method of Testing for Rating the Performance of Air Outlets and Inlets".
2. All pressures are in inches of water.
3. Neg. SP is negative static pressure.
4. NC values are based on room absorption of 10 dB re 10^{-12} watts.
5. Blanks (—) indicate an NC level below 15 dB.
6. Grille tested with damper. Corrections for grille without damper:
   — Multiply negative static pressure by 0.83
   — Subtract 4 dB from listed NC

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimetre.

Perforated Diffusers – Supply
PDC Series
c / w Individually Adjustable Curved Blades



Product Information

Models

Adjustable Curved Blades
Flush Face

Steel Construction	**PDC**
w/ Aluminum Face	**APDC**

Drop (Extended) Face

Steel Construction	**PDCE**
w/ Aluminum Face	**APDCE**

PRICE PDC / PDCE Series perforated face ceiling diffusers feature individually adjustable curved blades at the diffuser inlet, available in fixed 1, 2, 2-way corner, 3 and 4-way air patterns. The adjustable curved blades provide total flexibility in pattern adjustment from horizontal to vertical as well as low pressure loss and noise levels. Quick release latches on the hinged perforated face screen allow easy access for field adjustment of the blades. The drop (extended) face Model PDCE is available to complement tegular tile ceilings. For Fire-Rated applications please see Section G.

Features

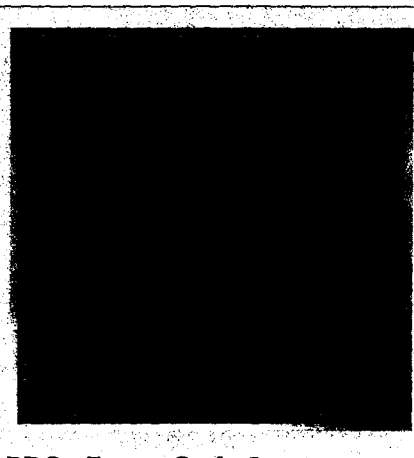
- Choice of cold rolled steel (PDC / PDCE) or aluminum face screen (APDC / APDCE) construction. Steel backpan and pattern controllers in both cases.
- Five air pattern options are available from 1 to 4-way.
- Hinged, removable perforated face screen with quick-release spring latches.
- Individually pivoting curved blades are located at the inlet neck and are field adjustable from horizontal to vertical air pattern.
- Choice of five frame styles. (PDCE and APDCE are available in Frame Style 3 only.)
- Complete range of available accessory dampers, equalizing grids etc.

Application

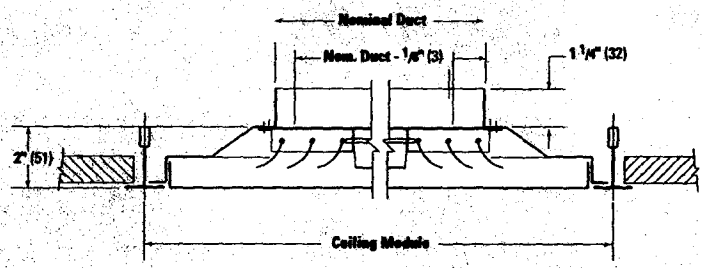
- PDC diffusers are designed for spaces requiring low noise and air pattern adjustment from horizontal to vertical.

Finish

White	**B12**
Optional Finishes – contact Price representative.	**SPL**



PDC - Frame Style 3



Dimensional Data — Imperial (inches) / Metric (mm)

Neck Size Nominal	Ceiling Module Size, Nominal 12 x 12 (305 x 305)	16x16 (406 x 406)	24x24 (610 x 610)
6 x 6 (152 x 152)	▼	▼	▼
8 x 8 (203 x 203)		▼	▼
10 x 10 (254 x 254)		▼	▼
12 x 12 (305 x 305)			▼
14 x 14 (356 x 356)			▼
15 x 15 (381 x 381)			▼
16 x 16 (406 x 406)			▼
18 x 18 (457 x 457)			▼
6" (152) Dia.	▼	▼	▼
8" (203) Dia.		▼	▼
10" (254) Dia.		▼	▼
12" (305) Dia.			▼
14" (356) Dia.			▼
15" (381) Dia.			▼
16" (406) Dia.			▼
18" (457) Dia.			▼

✔ Product Selection Checklist

1] Select Inlet diameter or Neck Size L x W based on desired performance characteristics.
2] Select Face Size based on ceiling module.
3] Select Outlet type by model number (Material, Flush or Drop Face).
4] Select Border style according to installation requirements.
5] Select Air Pattern Option (1, 2, 2C, 3 or 4-way).
6] Select Volume Control accessories, if desired.
7] Select Finish.

Example: 8" / 24" x 24" / PDC / 3 / 4 / B12

Product Information Index

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimetre.

Perforated Diffusers - Supply
PDC Series
c / w Individually Adjustable Curved Blades

Performance Data – 24" x 24" (610 x 610) Module

Inlet Size	Neck Velocity, fpm / Velocity Pressure, in w.g.		300 / 0.006	400 / 0.010	500 / 0.016	600 / 0.022	700 / 0.031	800 / 0.040	900 / 0.050	1000 / 0.062	1200 / 0.090	1400 / 0.122
	Total Pressure, in w.g.		**0.015**	**0.027**	**0.042**	**0.061**	**0.083**	**0.108**	**0.137**	**0.169**	**0.243**	**0.330**
	Flow Rate, cfm		**59**	**78**	**98**	**118**	**137**	**157**	**176**	**196**	**235**	**274**
	NC		-	-	-	**18**	**23**	**28**	**32**	**35**	**42**	**47**
6"		**4-Way**	2-3-5	3-4-6	3-5-7	4-5-8	4-6-8	5-6-9	5-7-9	6-7-10	6-8-11	7-8-12
	Throw	**3-Way**	2-3-6	3-4-8	3-5-10	4-6-11	5-7-12	5-8-12	6-9-13	7-10-14	8-11-15	9-12-16
	Feet	**2-Way**	2-3-7	3-5-9	4-6-10	5-7-11	5-8-12	6-9-12	7-9-13	8-10-14	9-11-15	9-12-16
		1-Way	2-4-8	3-5-11	4-7-13	5-8-16	6-9-19	7-11-21	8-12-23	9-13-24	11-16-26	13-19-28
	Total Pressure, in w.g.		**0.016**	**0.028**	**0.044**	**0.063**	**0.086**	**0.112**	**0.142**	**0.175**	**0.252**	**0.343**
	Flow Rate, cfm		**75**	**100**	**125**	**150**	**175**	**200**	**225**	**250**	**300**	**350**
	NC		-	-	-	**19**	**24**	**29**	**33**	**37**	**43**	**48**
6" x 6"		**4-Way**	2-4-6	3-5-7	4-6-8	5-6-9	5-7-9	6-7-10	6-8-11	6-8-11	7-9-12	8-9-13
	Throw	**3-Way**	3-4-8	3-5-10	4-6-11	5-8-12	6-9-13	7-10-14	8-11-15	8-11-16	10-12-17	11-13-19
	Feet	**2-Way**	3-4-9	4-6-10	5-7-11	6-9-12	7-9-13	8-10-14	9-11-15	9-11-16	10-12-17	11-13-19
		1-Way	2-5-10	4-7-14	6-8-17	7-10-20	8-12-22	9-14-24	10-15-25	11-17-27	14-20-29	16-22-32
	Total Pressure, in w.g.		**0.017**	**0.029**	**0.046**	**0.066**	**0.090**	**0.118**	**0.149**	**0.184**	**0.265**	**0.361**
	Flow Rate, cfm		**105**	**140**	**175**	**209**	**244**	**279**	**314**	**349**	**419**	**489**
	NC		-	-	-	**21**	**26**	**31**	**35**	**38**	**44**	**50**
8"		**4-Way**	3-5-7	4-6-8	5-7-9	6-7-10	6-8-11	7-8-12	7-9-13	8-9-13	8-10-14	9-11-16
	Throw	**3-Way**	3-5-10	5-7-12	6-9-13	7-10-14	8-11-15	9-12-17	10-12-18	11-13-18	12-14-20	13-15-22
	Feet	**2-Way**	4-6-10	5-8-12	6-9-13	8-10-14	9-11-15	10-12-17	10-12-18	11-13-18	12-14-20	13-15-22
		1-Way	4-7-14	6-9-18	8-11-22	9-14-25	11-16-27	12-18-28	14-21-30	15-22-32	18-25-35	21-27-38
	Total Pressure, in w.g.		**0.017**	**0.031**	**0.048**	**0.069**	**0.094**	**0.122**	**0.155**	**0.191**	**0.275**	**0.374**
	Flow Rate, cfm		**133**	**178**	**222**	**266**	**311**	**355**	**400**	**444**	**533**	**622**
	NC		-	-	**16**	**22**	**27**	**32**	**36**	**39**	**46**	**51**
8" x 8"		**4-Way**	4-6-8	5-7-9	6-7-11	7-8-12	7-9-12	8-9-13	8-10-14	9-11-15	9-12-16	10-12-18
	Throw	**3-Way**	4-6-11	6-8-13	7-10-15	8-11-16	10-12-17	11-13-19	11-14-20	12-15-21	13-16-23	14-17-25
	Feet	**2-Way**	5-7-11	6-9-13	8-10-15	9-11-16	10-12-17	11-13-19	11-14-20	12-15-21	13-16-23	14-17-25
		1-Way	6-9-17	8-11-23	9-14-25	11-17-28	13-20-30	15-23-32	17-24-34	19-25-36	23-28-39	24-30-42
	Total Pressure, in w.g.		**0.018**	**0.032**	**0.049**	**0.071**	**0.097**	**0.126**	**0.160**	**0.197**	**0.284**	**0.386**
	Flow Rate, cfm		**164**	**218**	**273**	**327**	**382**	**436**	**491**	**545**	**654**	**763**
	NC		-	-	**17**	**23**	**28**	**33**	**37**	**40**	**47**	**52**
10"		**4-Way**	5-6-9	6-7-10	7-8-12	7-9-13	8-10-14	9-10-15	9-11-16	10-12-17	10-13-18	11-14-20
	Throw	**3-Way**	5-8-13	7-10-15	8-12-16	10-13-18	11-14-19	12-15-21	13-16-22	13-16-23	15-18-25	16-19-27
	Feet	**2-Way**	6-9-13	8-10-15	9-12-16	10-13-18	11-14-19	12-15-21	13-16-22	13-16-23	15-18-25	16-19-27
		1-Way	7-10-20	9-14-25	11-17-28	14-20-31	16-23-33	18-25-35	20-27-38	23-28-40	25-31-43	27-33-47
	Total Pressure, in w.g.		**0.018**	**0.033**	**0.051**	**0.074**	**0.100**	**0.131**	**0.166**	**0.205**	**0.295**	**0.401**
	Flow Rate, cfm		**208**	**278**	**347**	**416**	**486**	**555**	**625**	**694**	**833**	**972**
	NC		-	-	**18**	**24**	**30**	**34**	**38**	**42**	**48**	**53**
10" x 10"		**4-Way**	6-7-10	7-8-12	8-9-13	8-10-14	9-11-16	10-12-17	10-12-18	11-13-19	12-14-20	13-16-22
	Throw	**3-Way**	6-9-14	8-12-16	10-13-18	12-14-20	13-15-22	13-16-23	14-17-25	15-18-26	16-20-29	18-22-31
	Feet	**2-Way**	7-10-14	9-12-16	11-13-18	12-14-20	13-15-22	13-16-23	14-17-25	15-18-26	16-20-29	18-22-31
		1-Way	8-13-24	11-17-28	14-21-32	17-24-35	20-26-37	22-28-40	24-30-42	26-32-45	28-35-49	31-37-53
	Total Pressure, in w.g.		**0.019**	**0.033**	**0.052**	**0.075**	**0.102**	**0.133**	**0.169**	**0.208**	**0.300**	**0.409**
	Flow Rate, cfm		**236**	**314**	**393**	**471**	**550**	**628**	**707**	**785**	**942**	**1099**
	NC		-	-	**19**	**25**	**30**	**35**	**39**	**42**	**48**	**54**
12"		**4-Way**	6-8-11	7-9-13	8-10-14	9-11-15	10-12-17	10-13-18	11-13-19	11-14-20	13-15-22	14-17-23
	Throw	**3-Way**	7-10-15	9-12-18	11-14-20	12-15-21	13-16-23	14-18-25	15-19-26	16-20-28	18-21-30	19-23-33
	Feet	**2-Way**	8-11-15	10-12-18	11-14-20	12-15-21	13-16-23	14-18-25	15-19-26	16-20-28	18-21-30	19-23-33
		1-Way	9-14-26	12-19-30	15-23-34	19-26-37	22-28-40	25-30-43	26-32-45	27-34-48	30-37-52	32-40-56
	Total Pressure, in w.g.		**0.019**	**0.035**	**0.054**	**0.078**	**0.106**	**0.138**	**0.175**	**0.216**	**0.312**	**0.424**
	Flow Rate, cfm		**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**	**1200**	**1400**
	NC		-	-	**20**	**26**	**31**	**36**	**40**	**44**	**50**	**55**
12" x 12"		**4-Way**	7-9-12	8-10-14	9-11-16	10-12-17	11-13-19	12-14-20	12-15-21	13-16-22	14-17-24	15-19-26
	Throw	**3-Way**	8-12-17	11-14-20	13-16-22	14-17-24	15-19-26	16-20-28	17-21-30	18-22-31	20-24-34	21-26-37
	Feet	**2-Way**	10-12-17	11-14-20	13-16-22	14-17-24	15-19-26	16-20-28	17-21-30	18-22-31	20-24-34	21-26-37
		1-Way	11-17-29	15-23-34	19-27-38	23-29-42	26-32-45	28-34-48	29-36-51	31-38-54	34-42-59	37-45-63

See Performance Notes Page C69.

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimetre.

PDC Series

c / w Individually Adjustable Curved Blades

price®

Performance Data – 24" x 24" (610 x 610) Module *(continued)*

Inlet Size	Neck Velocity, fpm Velocity Pressure, in w.g.		300 0.006	400 0.010	500 0.016	600 0.022	700 0.031	800 0.040	900 0.050	1000 0.062	1200 0.090	1400 0.122
	Total Pressure, in w.g.		**0.020**	**0.035**	**0.055**	**0.079**	**0.107**	**0.140**	**0.177**	**0.219**	**0.315**	**0.428**
	Flow Rate, cfm		**321**	**428**	**535**	**641**	**748**	**855**	**962**	**1069**	**1283**	**1497**
	NC		**-**	**-**	**20**	**27**	**32**	**36**	**40**	**44**	**50**	**55**
14"		**4-Way**	7-9-13	8-10-15	9-12-16	10-13-18	11-14-19	12-15-21	13-16-22	13-16-23	15-18-25	16-19-27
	Throw	**3-Way**	9-13-18	12-14-20	13-16-23	14-18-25	16-19-27	17-20-29	18-22-31	19-23-32	20-25-35	22-27-38
	Feet	**2-Way**	10-13-18	12-14-20	13-16-23	14-18-25	16-19-27	17-20-29	18-22-31	19-23-32	20-25-35	22-27-38
		1-Way	12-18-30	16-24-35	20-28-39	24-30-43	27-33-46	29-35-50	30-37-53	32-39-55	35-43-61	38-46-66
	Total Pressure, in w.g.		**0.020**	**0.036**	**0.057**	**0.082**	**0.111**	**0.145**	**0.184**	**0.227**	**0.327**	**0.444**
	Flow Rate, cfm		**408**	**544**	**681**	**817**	**953**	**1089**	**1225**	**1361**	**1633**	**1905**
	NC		**-**	**-**	**22**	**28**	**33**	**37**	**41**	**45**	**51**	**56**
14" x 14"		**4-Way**	8-10-14	10-12-16	11-13-18	12-14-20	13-15-22	13-16-23	14-17-25	15-18-26	16-20-29	18-22-31
	Throw	**3-Way**	11-14-20	13-16-23	15-18-26	16-20-28	18-22-31	19-23-33	20-24-35	21-26-37	23-28-40	25-31-43
	Feet	**2-Way**	12-14-20	13-16-23	15-18-26	16-20-28	18-22-31	19-23-33	20-24-35	21-26-37	23-28-40	25-31-43
		1-Way	14-22-34	19-28-40	24-31-44	28-34-48	30-37-52	32-40-56	34-42-59	36-44-63	40-48-69	43-52-74
	Total Pressure, in w.g.		**0.020**	**0.036**	**0.056**	**0.080**	**0.109**	**0.143**	**0.181**	**0.223**	**0.321**	**0.437**
	Flow Rate, cfm		**368**	**491**	**614**	**736**	**859**	**982**	**1104**	**1227**	**1472**	**1718**
	NC		**-**	**-**	**21**	**27**	**32**	**37**	**41**	**45**	**51**	**56**
15"		**4-Way**	8-10-14	9-11-16	10-12-18	11-14-19	12-15-21	13-16-22	14-17-23	14-18-25	16-19-27	17-21-29
	Throw	**3-Way**	10-13-19	13-16-22	14-17-25	16-19-27	17-21-29	18-22-31	19-23-33	20-25-35	22-27-38	24-29-41
	Feet	**2-Way**	11-13-19	13-16-22	14-17-25	16-19-27	17-21-29	18-22-31	19-23-33	20-25-35	22-27-38	24-29-41
		1-Way	13-20-33	18-27-38	22-30-42	27-33-46	29-35-50	31-38-53	33-40-56	34-42-59	38-46-65	41-50-70
	Total Pressure, in w.g.		**0.021**	**0.037**	**0.058**	**0.083**	**0.114**	**0.148**	**0.188**	**0.232**	**0.334**	**0.454**
	Flow Rate, cfm		**469**	**625**	**782**	**938**	**1094**	**1250**	**1407**	**1563**	**1876**	**2188**
	NC		**-**	**-**	**22**	**28**	**34**	**38**	**42**	**46**	**52**	**57**
15" x 15"		**4-Way**	9-11-15	10-13-18	11-14-20	13-15-22	14-17-23	14-18-25	15-19-27	16-20-28	18-22-31	19-23-33
	Throw	**3-Way**	12-15-21	14-18-25	16-20-28	18-21-30	19-23-33	20-25-35	21-26-37	23-28-39	25-30-43	27-33-46
	Feet	**2-Way**	12-15-21	14-18-25	16-20-28	18-21-30	19-23-33	20-25-35	21-26-37	23-28-39	25-30-43	27-33-46
		1-Way	16-24-37	21-30-42	27-34-47	30-37-52	32-40-56	35-42-60	37-45-64	39-47-67	42-52-73	46-56-79
	Total Pressure, in w.g.		**0.020**	**0.036**	**0.057**	**0.082**	**0.112**	**0.146**	**0.184**	**0.228**	**0.328**	**0.446**
	Flow Rate, cfm		**419**	**558**	**698**	**838**	**977**	**1117**	**1256**	**1396**	**1675**	**1954**
	NC		**-**	**-**	**22**	**28**	**33**	**38**	**42**	**45**	**51**	**57**
16"		**4-Way**	8-10-14	10-12-17	11-13-19	12-14-20	13-16-22	14-17-24	14-18-25	15-19-26	17-20-29	18-22-31
	Throw	**3-Way**	11-14-20	14-17-23	15-18-26	17-20-29	18-22-31	19-23-33	20-25-35	21-26-37	23-29-41	25-31-44
	Feet	**2-Way**	12-14-20	14-17-23	15-18-26	17-20-29	18-22-31	19-23-33	20-25-35	21-26-37	23-29-41	25-31-44
		1-Way	15-22-35	20-28-40	24-32-45	28-35-49	31-38-53	33-40-57	35-43-60	37-45-63	40-49-69	43-53-75
	Total Pressure, in w.g.		**0.021**	**0.038**	**0.059**	**0.085**	**0.116**	**0.151**	**0.191**	**0.236**	**0.340**	**0.463**
	Flow Rate, cfm		**533**	**711**	**889**	**1067**	**1245**	**1422**	**1600**	**1778**	**2134**	**2489**
	NC		**-**	**15**	**23**	**29**	**34**	**39**	**43**	**46**	**53**	**58**
16" x 16"		**4-Way**	9-12-16	11-13-19	12-15-21	13-16-23	14-18-25	15-19-27	16-20-28	17-21-30	19-23-33	20-25-35
	Throw	**3-Way**	13-16-23	15-19-26	17-21-30	19-23-32	20-25-35	22-26-37	23-28-40	24-30-42	26-32-46	29-35-49
	Feet	**2-Way**	13-16-23	15-19-26	17-21-30	19-23-32	20-25-35	22-26-37	23-28-40	24-30-42	26-32-46	29-35-49
		1-Way	18-26-39	23-32-45	29-36-51	32-39-55	35-42-60	37-45-64	39-48-68	41-51-72	45-55-78	49-60-85
	Total Pressure, in w.g.		**0.021**	**0.038**	**0.059**	**0.085**	**0.116**	**0.151**	**0.191**	**0.236**	**0.340**	**0.463**
	Flow Rate, cfm		**530**	**707**	**884**	**1060**	**1237**	**1414**	**1590**	**1767**	**2120**	**2474**
	NC		**-**	**20**	**27**	**34**	**39**	**43**	**47**	**51**	**57**	**62**
18"		**4-Way**	9-12-16	11-13-19	12-15-21	13-16-23	14-18-25	15-19-27	16-20-28	17-21-30	19-23-33	20-25-35
	Throw	**3-Way**	13-16-23	15-19-26	17-21-29	19-23-32	20-25-35	21-26-37	23-28-39	24-29-42	26-32-46	28-35-49
	Feet	**2-Way**	13-16-23	15-19-26	17-21-29	19-23-32	20-25-35	21-26-37	23-28-39	24-29-42	26-32-46	28-35-49
		1-Way	17-26-39	23-32-45	29-36-50	32-39-55	34-42-60	37-45-64	39-48-68	41-50-71	45-55-78	49-60-84
	Total Pressure, in w.g.		**0.022**	**0.039**	**0.061**	**0.088**	**0.120**	**0.157**	**0.198**	**0.245**	**0.353**	**0.480**
	Flow Rate, cfm		**675**	**900**	**1125**	**1350**	**1575**	**1800**	**2025**	**2250**	**2700**	**3150**
	NC		**-**	**21**	**29**	**35**	**40**	**44**	**48**	**52**	**58**	**63**
18" x 18"		**4-Way**	11-13-18	12-15-21	14-17-24	15-18-26	16-20-28	17-21-30	18-23-32	19-24-34	21-26-37	23-28-40
	Throw	**3-Way**	15-18-26	17-21-30	19-23-33	21-26-36	23-28-39	24-30-42	26-32-45	27-33-47	30-36-51	32-39-56
	Feet	**2-Way**	15-18-26	17-21-30	19-23-33	21-26-36	23-28-39	24-30-42	26-32-45	27-33-47	30-36-51	32-39-56
		1-Way	21-31-44	28-36-51	33-40-57	36-44-62	39-48-67	42-51-72	44-54-76	46-57-80	51-62-88	55-67-95

Performance Notes:

1. Tested in accordance with ASHRAE Standard 70-1991 "Method of Testing for Rating the Performance of Air Outlets and Inlets."
2. Air flow is in cubic feet per minute, cfm.
3. All pressures are in inches of water. To obtain static pressure, subtract the velocity pressure at the top of the column from the listed total pressure.
4. Throw values are given in feet to terminal velocities of 150 fpm (minimum), 100 fpm (middle) and 50 fpm (maximum).
5. Throw data is based on supply air and room air being at isothermal conditions.
6. The NC values, sound pressure level, are based on a room absorption of 10 dB re 10^{-12} watts and one diffuser.
7. Blanks (—) indicate an NC level below 15 dB.

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimetre.

Perforated Face
10 Series

Product Information

Model

Grille

Steel Core Construction	**10**
Aluminum Core Construction	**10A**

Application:

- Mid to high capacity return with core free area of approximately 50%.
- Perforated core blends unobtrusively with most interior design conditions.
- Ideally suited for ceiling mounted return applications.

Construction:

- Available in steel or aluminum core construction. (Aluminum core recommended for high humidity applications.)
- Extruded aluminum borders for clean, crisp detailing.
- Core 3/16" (8) holes on 1/4" (6) centers staggered 60°.
- Mounting frames available to accent grille border and protect wall surface during grille removal.

For Fire-Rated applications please see Section G.

Mounting / Finish Options

Border Style	
Surface Mount 1 1/4" (32) Flat (Standard)	**F**
T-Bar Lay-In Inverted 1" (25) Tee	**TB**
Optional Mounting Frame	
For **F** Border	**D**
Fastening	
Counter sunk screwholes c/w oval-head screws	**A**
No screwholes	**Ø**
Finish	
White	**B12**
Optional finishes – contact Price representative.	**SPL**

Available Sizes

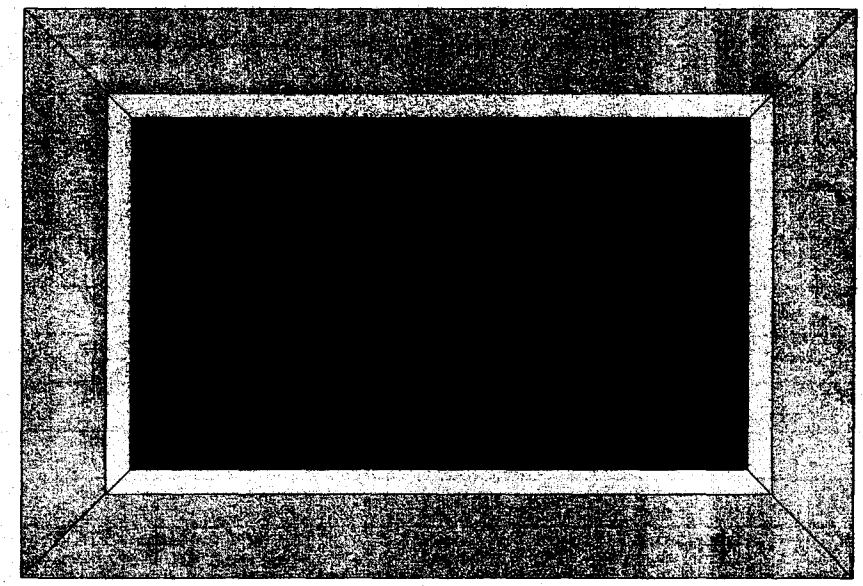
Minimum	Maximum*
6" x 4" (152 x 102)	**48" x 24"** (1219 x 610)

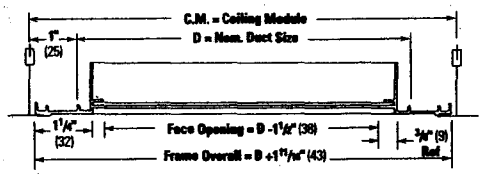
* One piece

- For oversize grille construction, see page D105-D106.

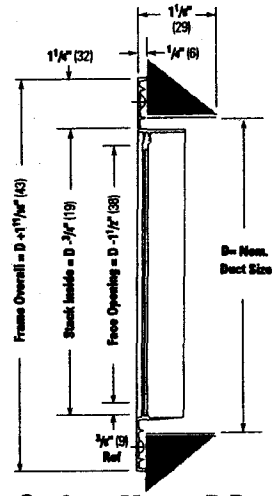
Product Information Index

Perforated Face Return





Lay-In TB Border



Surface Mount F Border

✓ Product Selection Checklist

1] Select Unit Size based on desired performance characteristics.
2] Select Outlet type by model number (Core style).
3] Select Border style according to installation requirements (**F** is standard).
4] Select Module Size if TB Border selected. (Note: Maximum duct size = module size-2" (50))
5] Select Mounting frame if desired.
6] Select Fastening type (**A** is standard, n/a with TB Border).
7] Select Finish.

Example: **24" x 12" / 10 / F / A / B12**
22" x 22" / 10A / TB / 24" x 24" / B12

Application Recommendations:
Surface Mount – **F** Border, **A** Fastening.
T-Bar Lay-In – **TB** Border, Fastening n/a

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimetre.

Performance Data

Core Area	Nominal Size*				Core Velocity	200	300	400	500	600	700	800	900	1000
					Velocity Pressure	0.002	0.006	0.010	0.016	0.022	0.031	0.040	0.050	0.062
					Negative SP	0.019	0.043	0.076	0.118	0.171	0.232	0.303	0.384	0.474
0.15	6x5				CFM	30	45	60	75	90	105	120	135	150
	7x4				NC	—	—	—	20	25	29	33	36	39
0.18	6x6	7x5			CFM	36	54	72	90	108	126	144	162	180
	8x4				NC	—	—	—	20	25	29	33	36	39
0.22	7x6	7x5			CFM	44	66	88	110	132	154	176	198	220
	10x4				NC	—	—	—	20	25	29	33	36	39
0.26	6x6	10x5			CFM	52	78	104	130	156	182	208	234	260
	12x4				NC	—	—	—	20	25	29	33	36	39
0.30	14x4				CFM	60	90	120	150	180	210	240	270	300
					NC	—	—	—	20	25	29	33	36	39
0.34	10x6	12x5			CFM	68	102	136	170	204	238	272	306	340
	16x4				NC	—	—	—	20	25	29	33	36	39
0.39	8x8	12x6			CFM	78	117	156	195	234	273	312	351	390
	14x5	18x4			NC	—	—	—	20	25	29	33	36	39
0.46	20x4	14x6			CFM	92	138	184	230	276	322	368	414	460
	16x5	10x8			NC	—	—	—	20	25	29	33	36	39
0. 52	24x4	16x6			CFM	104	156	208	260	312	364	416	468	520
	18x5				NC	—	—	—	20	25	29	33	36	39
0.60	28x4	18x6	10x10		CFM	120	180	240	300	360	420	480	540	600
	20x5	12x8			NC	—	—	—	20	25	29	33	36	39
0.69	30x4	20x6	12x10		CFM	138	207	276	345	414	483	552	621	690
	24x5	14x8			NC	—	—	—	20	25	29	33	36	39
0.81	36x4	22x6	14x10		CFM	162	243	324	405	486	567	648	729	810
	28x5	16x8			NC	—	—	—	20	25	29	33	36	39
0.90	40x4	26x6	16x10		CFM	180	270	360	450	540	630	720	810	900
	30x5	18x8	12x12		NC	—	—	—	20	25	29	33	36	39
1.07	48x4	30x6	14x12		CFM	214	321	428	535	642	749	856	963	1070
	36x5	18x10			NC	—	—	—	20	25	29	33	36	39
1.18	34x6	20x10	14x14		CFM	236	354	472	590	708	826	944	1062	1180
	24x8	16x12			NC	—	—	—	20	25	29	33	36	39
1.34	60x4	36x6	16x14		CFM	268	402	536	670	804	938	1072	1206	1340
	48x5	18x12			NC	—	—	—	20	25	29	33	36	39
1.6	72x4	24x10	18x14		CFM	320	480	640	800	960	1120	1280	1440	1600
	30x8	22x12	16x16		NC	—	—	—	20	25	29	33	36	39
1.8	60x5	36x8	24x12	18x16	CFM	360	540	720	900	1080	1260	1440	1620	1800
	48x6	30x10	20x14		NC	—	—	—	20	25	29	33	36	39
2.08	72x5	40x8	30x12	20x16	CFM	416	624	832	1040	1248	1456	1664	1872	2080
	60x6	36x10	24x14	18x18	NC	—	—	—	20	25	29	33	36	39
2.45	72x6	32x12	24x16		CFM	490	735	980	1225	1470	1715	1960	2205	2450
	48x8	26x14	20x18		NC	—	—	—	20	25	29	33	36	39
2.78	36x12	26x16	22x20		CFM	556	834	1112	1390	1668	1946	2224	2502	2780
	30x14	24x18			NC	—	—	—	20	25	29	33	36	39
3.11	60x8	40x12	30x16	24x20	CFM	622	933	1244	1555	1866	2177	2488	2799	3110
	48x10	36x14	26x18		NC	—	—	—	20	25	29	33	36	39
3.61	72x8	48x12	30x18		CFM	722	1083	1444	1805	2166	2527	2888	3249	3610
	60x10	36x16	24x24		NC	—	—	—	20	25	29	33	36	39
4.29	48x14	32x20			CFM	858	1287	1716	2145	2574	3003	3432	3861	4290
	36x18	28x24			NC	—	—	—	20	25	29	33	36	39
4.65	72x10	36x20			CFM	930	1395	1860	2325	2790	3255	3720	4185	4650
	48x16	30x24			NC	—	—	—	20	25	29	33	36	39
5.58	72x12	48x18			CFM	1116	1674	2232	2790	3348	3906	4468	5022	5580
	60x14	36x24			NC	—	—	—	20	25	29	33	36	39
6.25	72x14	48x20			CFM	1250	1875	2500	3125	3750	4375	5000	5625	6250
	60x16	30x30			NC	—	—	—	20	25	29	33	36	39

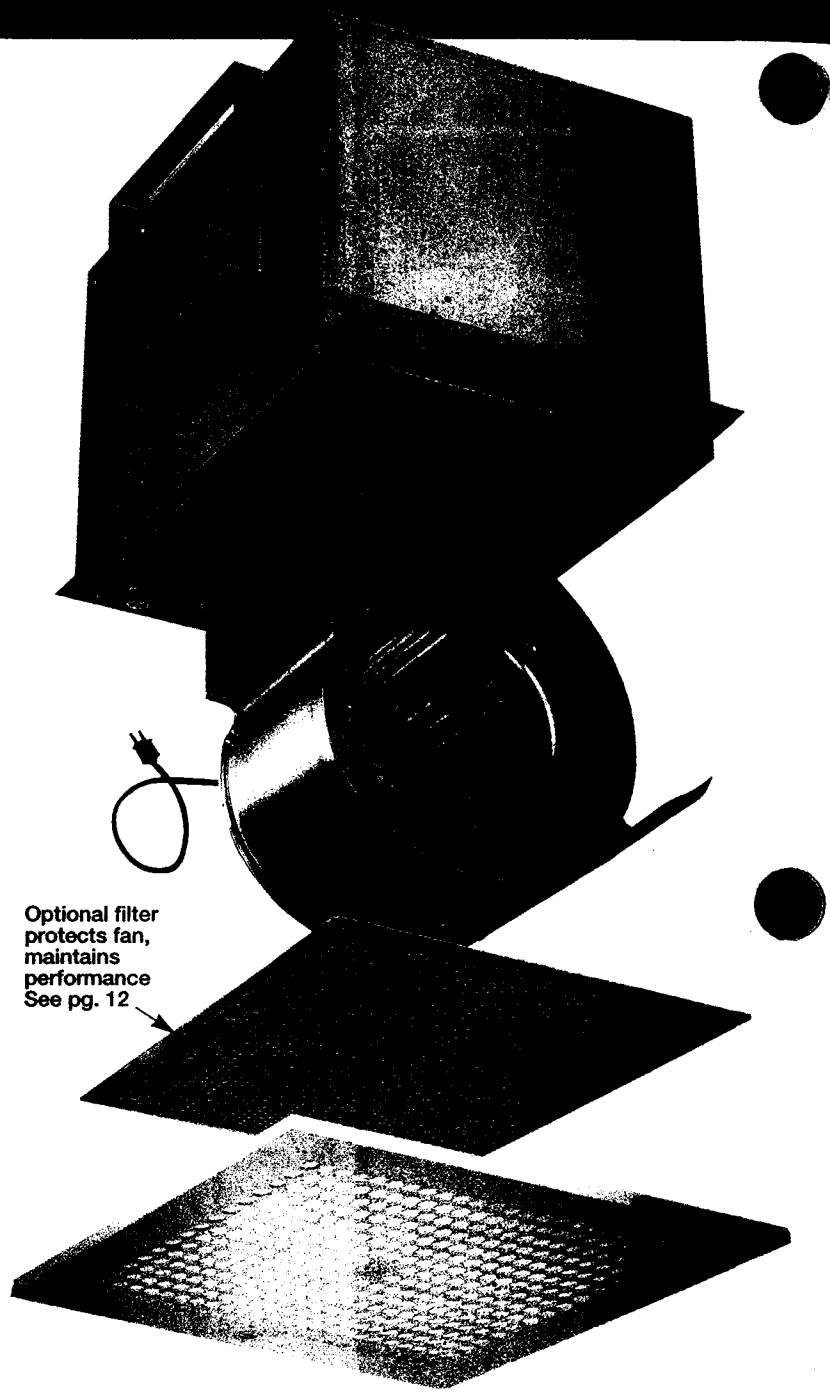
Performance Notes

1. Tested in accordance with ASHRAE Standard 70-1991 "Method of Testing for Rating the Performance of Air Outlets and Inlets".
2. All pressures are in inches of water.
3. The NC values are based on a room absorption of 10 dB, re 10^{-12} watts.
4. Blanks (—) indicate an NC level below 15 dB.
5. Air flow is in cubic feet per minute, cfm.
6. Neg. SP is negative static pressure.

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimetre.

PRODUCT FEATURES

- Fan housing constructed of corrosion resistant galvanized steel.
- Fan housing interior is lined with sound absorbing insulation for quiet operation.
- Grilles are white and attach to fan housing with two screws. Grilles for sizes 210-228 are made of high impact polystyrene. Grilles for sizes 250-265 are constructed of aluminum, coated with baked enamel. All finishes are non-yellowing.
- Outlet duct connection with integral backdraft damper can be converted from horizontal to vertical discharge.
- Fan scroll is constructed of galvanized steel.
- Fan wheels are double width forward curved centrifugal type in a single scroll for SP 210-258. SP 260-265 have twin double width forward curved wheels in separate scrolls driven by a single motor. All wheels are dynamically balanced for vibration free operation.
- Motors are 115/60/1 with built in thermal overload protection, sized to match fan loads and mounted on vibration isolators. Motors are compatible for use with speed controls. Power assemblies can be easily unplugged and removed for inspection or service.
- Angle mounting brackets can be adjusted to any typical ceiling material thickness.



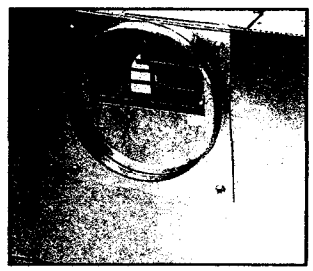
Exclusive Electrical Wiring Feature

A. Greenheck SP models are the only fans of this type with an electrical access cover located on the housing exterior. This feature permits external wiring without removing the power assembly, saving installation time and cost.

Vertical Discharge

B. Photo shows exhaust duct adapter installed in the optional vertical position. The power assembly must be rotated to match the duct adapter position.

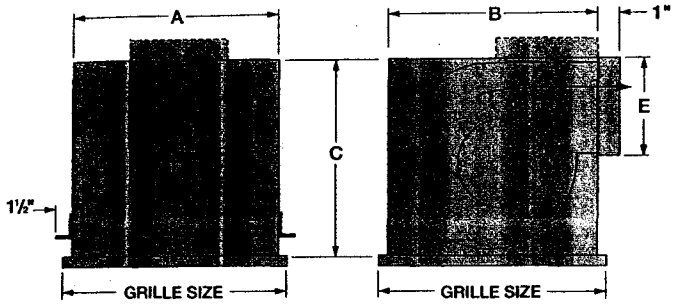
Round Duct Connector



The model RDC round duct connector replaces the standard outlet for use with round ductwork.

The RDC does not include a damper. The backdraft damper included in the discharge accessory is typically adequate.

The RDC must be specified as an accessory item and ships loose for field installation. See page 14 for details.



SP 210-258

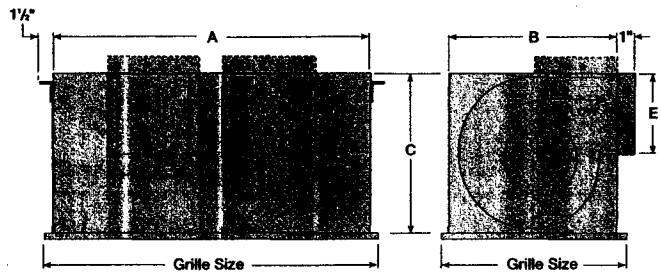
DIMENSIONAL DATA

Model	A	B	C	D	E	Grille Size	WT.
210, 216, 218	13 1/4	10 5/8	10 1/2	8	6	14 3/4 x 12 3/4	15
224, 226, 228	14	11 7/8	11 1/2	8	8	14 3/4 x 12 3/4	21
250, 252	18	14 3/8	14 1/2	8	8	19 3/8 x 16 3/8	31
255, 258	18	14 3/8	14 1/2	10	8	19 3/8 x 16 3/8	34

For complete dimensional information, see submittal drawings.
**Optional Discharge Position

PERFORMANCE DATA

Model	RPM	AMPS	Watts (Input)		CFM/Static Pressure in inches of W.G.							
					0.000	0.100	0.125	0.250	0.375	0.500	0.625	0.750
SP-210	950	0.58	49	CFM	119	110	106	88				
				Sones	1.3	1.2	1.2	1.6				
SP-216	1100	0.62	53	CFM	135	123	121	104				
				Sones	1.4	1.7	1.8	1.9				
SP-218	1400	1.30	113	CFM	216	197	192	167	133			
				Sones	3.2	2.8	2.9	3.1	3.4			
SP-224	1000	0.77	83	CFM	272	251	246	227	210	185	157	119
				Sones	2.9	3.0	3.0	3.4	4.4	4.6	4.9	5.2
SP-226	1050	0.72	81	CFM	315	293	287	257	231	207	175	124
				Sones	3.2	3.3	3.3	3.6	3.9	4.1	4.5	5.5
SP-228	1350	1.34	135	CFM	410	395	391	368	345	325	307	279
				Sones	5.4	5.4	5.4	5.7	6.0	6.3	6.4	6.7
SP-250	1000	1.74	121	CFM	443	413	405	351	305	109		
				Sones	4.1	3.8	3.7	3.7	4.3	3.7		
SP-252	1070	3.30	224	CFM	557	512	501	439	392	325		
				Sones	6.0	5.7	5.6	5.5	5.4	4.7		
SP-255	1080	4.40	285	CFM	752	714	701	653	588	485	320	
				Sones	7.4	7.2	7.2	7.0	6.8	6.7	6.5	
SP-258	1600	3.30	348	CFM	812	782	775	741	704	665	625	581
				Sones	10.2	10.2	10.2	9.9	9.5	9.5	9.4	9.4



SP 260-265

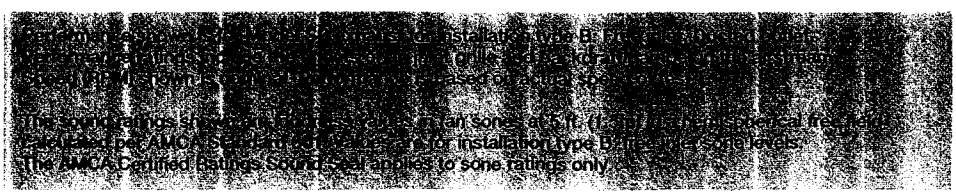
DIMENSIONAL DATA

Model	A	B	C	D	E	Grille Size	WT.
260, 262 264, 265	23 3/4	14 3/8	14 1/2	18 3/4	8	25x16 3/8	56

For complete dimensional information, see submittal drawings.
**Optional Discharge Position

PERFORMANCE DATA

Model	RPM	AMPS	Watts (Input)		CFM/Static Pressure in inches of W.G.							
					0.000	0.100	0.125	0.250	0.375	0.500	0.625	0.750
SP-260	950	4.00	285	CFM	955	907	896	841	773	701		
				Sones	5.2	5.7	5.8	6.1	6.2	6.2		
SP-262	1095	6.30	420	CFM	1125	1058	1043	964	885	796	662	
				Sones	7.2	7.0	6.9	6.8	6.6	6.5	6.4	
SP-264	1450	7.40	786	CFM	1455	1414	1404	1353	1307	1262	1218	1174
				Sones	11.6	11.6	11.7	11.6	11.5	11.6	11.6	11.6
SP-265	1610	8.60	818	CFM	1607	1568	1558	1506	1449	1407	1369	1323
				Sones	12.4	12.1	12.0	12.0	11.9	12.8	14.1	15.9



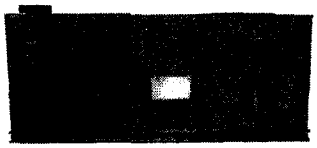
GREENHECK

PRODUCT MATRIX

Cabinet	Tonnage	Model	Cooling Efficiency		
			LGA/LCA		LHA
			High	Standard	High
A Box	3	036	12	10	N/A
	3.5	042	12	10	N/A
	4	048	12	10	N/A
	5	060	12	10	N/A
	6	072	10.5	9	N/A
A+ Box	7.5	088	10.2	9	9
	8.5	100	N/A	9	N/A
B Box	8.5	102	11	9	N/A
	10	120	11	9	10.3
	12.5	150	N/A	9	N/A
C Box	13	156	11.5	N/A	N/A
	15	180	11.5	9.2	10
	17.5	210	11.2	9	N/A
	20	240	11	9	10.5
D Box	25	300	10	9	N/A
	30	360	10	N/A	N/A

LENNOX L SERIES® VS. CARRIER 48TJ & CARRIER 48HJ

Lennox L Series



A Box

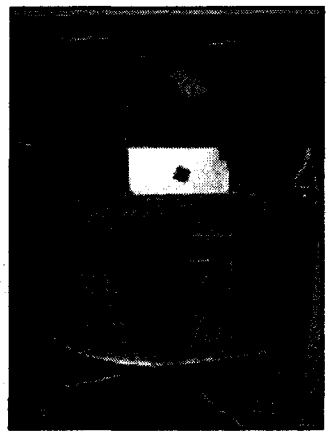
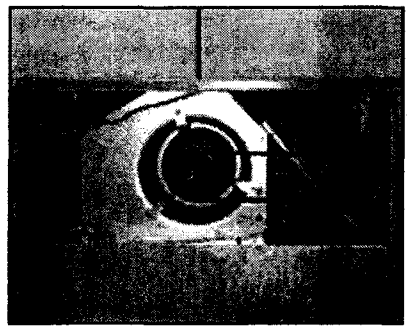
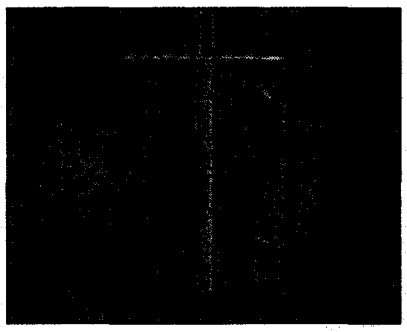
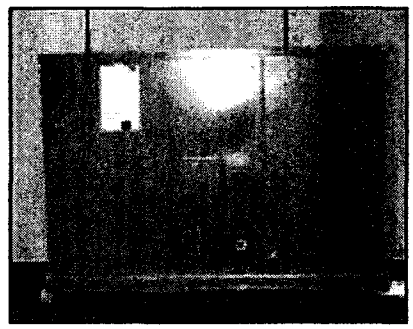
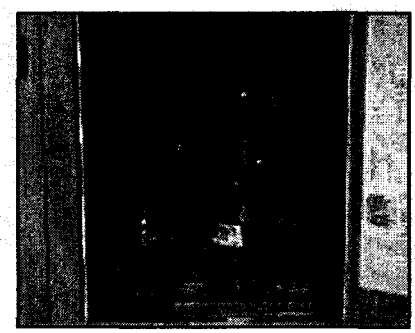
Carrier 48HJ

Feature	*Lennox*					*Carrier*					*Advantage*
Cap., Tons	3	3.5	4	5	6	3	3.5	4	5	6	
ARI Standard Efficiency											
	Lennox L Series – A Box					**Carrier 48TJ Model**					
EER/SEER	–/10	–/10	–/10	–/10	9.0/–	–/10	N/A	–/10	–/10	9.0/–	
Cap., Btuh	36,000	42,000	48,000	57,500	72,000	35,000	–	47,000	57,000	72,000	
S/T Ratio	0.71	0.70	0.71	0.72	0.72	0.71	–	0.70	0.74	0.70	
Cabinet	82 cu.ft.	82 cu.ft.	82 cu.ft.	82 cu.ft.	82 cu.ft.	79 cu. ft.	–	79 cu. ft.	79 cu. ft.	79 cu. ft.	
ARI High-Efficiency											
	Lennox L Series – A Box					**Carrier 48HJ Model**					
EER/SEER	–/12	–/12	–/12	–/12	10.5/–	–/13	N/A	–/13	–/13	11/–	
Cap., Btuh	35,800	42,500	48,000	60,000	71,500	36,000	–	47,000	60,000	74,000	
S/T Ratio	0.73	0.74	0.70	0.73	0.73	0.72	–	0.69	0.70	0.72	
Cabinet	82 cu.ft.	82 cu.ft.	82 cu.ft.	82 cu.ft.	82 cu.ft.	79 cu. ft.	–	79 cu. ft.	79 cu. ft.	79 cu. ft.	

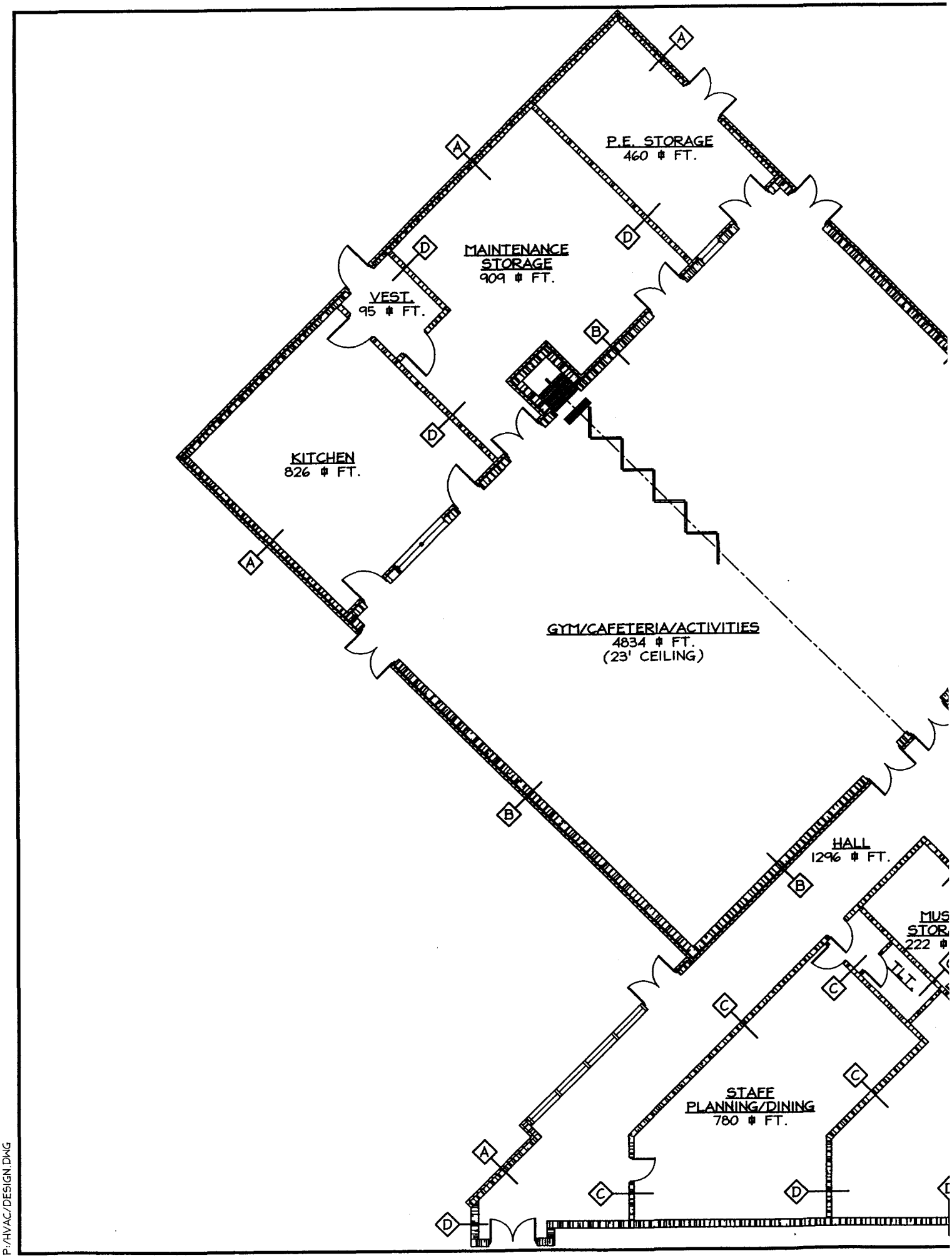
Features

Controls	IMC – Fully integrated with virtually unlimited diagnostics. Includes low ambient and low refrigerant pressure functions. Compatible with most energy management systems and electromechanical thermostats.	IGC – gas units.	Lennox
115 Volt GFI Outlet	15 amp field wired.	Service option package – 115V.	
Factory Installed Options	Disconnect switch with weather proof cover, gear driven economizer and gravity exhaust, smoke detectors, high-efficiency blower motors, coil corrosion protection, dirty filter switch, service valves and DDC control modules. Also available, Humiditrol™ dehumidification.	Apollo DDC, service packages "A" or "H" with the following: GFI, disconnect, RA smoke detector, firestat, hinged access panels. Also available, MoistureMiser™ dehumidification.	Lennox
Utility Connections	Gas = side only; Electric = bottom or side entry. Optional bottom gas thru the curb.	Gas = side only; Electric = bottom or side entry.	
Service Access	Standard tooless, hinged access doors.	Available with optional Service Option Packages.	Lennox
Std. Low Ambient	0° F standard.	25° F standard.	Lennox
Freeze Protection	Standard.	Acutrol.	
Thermostatic Expansion Valve	Standard, with removable power element.	Not Available.	Lennox
Latent Control Option	1 row coil downstream of evaporator. Uses hot gas from compressor to reheat supply air. Humiditrol provides dehumidification on demand.	1 row coil downstream of evaporator Uses hot liquid from condenser coil to reheat supply air. Cooling demand is required to initiate MoistureMiser operation.	Lennox

Feature Comparison

LENNOX ADVANTAGES	CARRIER Disadvantages
 The motor drive pulley is fully accessible for easy adjustment. Two inch commercial grade pleated filters.	 Rigidity of motor mounting is weak and deflects easily as shown in the photo. Access to indoor coil is difficult. Standard two inch unpleated fiberglass filters
 Lennox uses heavy duty galvanized steel hinges with 1/8" brass pins on toolless access panels.	 With the exception of the filter access, all other service require removing sheet metal screws to remove cabinet panels. Removed panels are subject to wind-blown damage.
 Compressors are easily accessible for testing and service. Independent and isolated compartment facilitates accurate checking of refrigerant charge. TXV's are standard on all L Series units.	 In the Carrier unit, access to all refrigeration service ports and filter-dryers are behind the compressors. Most units do not have TXV's. Open compressor-condenser compartment causes difficulty when checking refrigerant charge.
 Gas heat section is fully accessible for service, with a slide-out heat exchanger. Optional stainless steel heat exchanger.	 Access to the Carrier gas heat section is particularly difficult. A separation panel inside the unit must be removed and the technician must go into the unit to service the burners

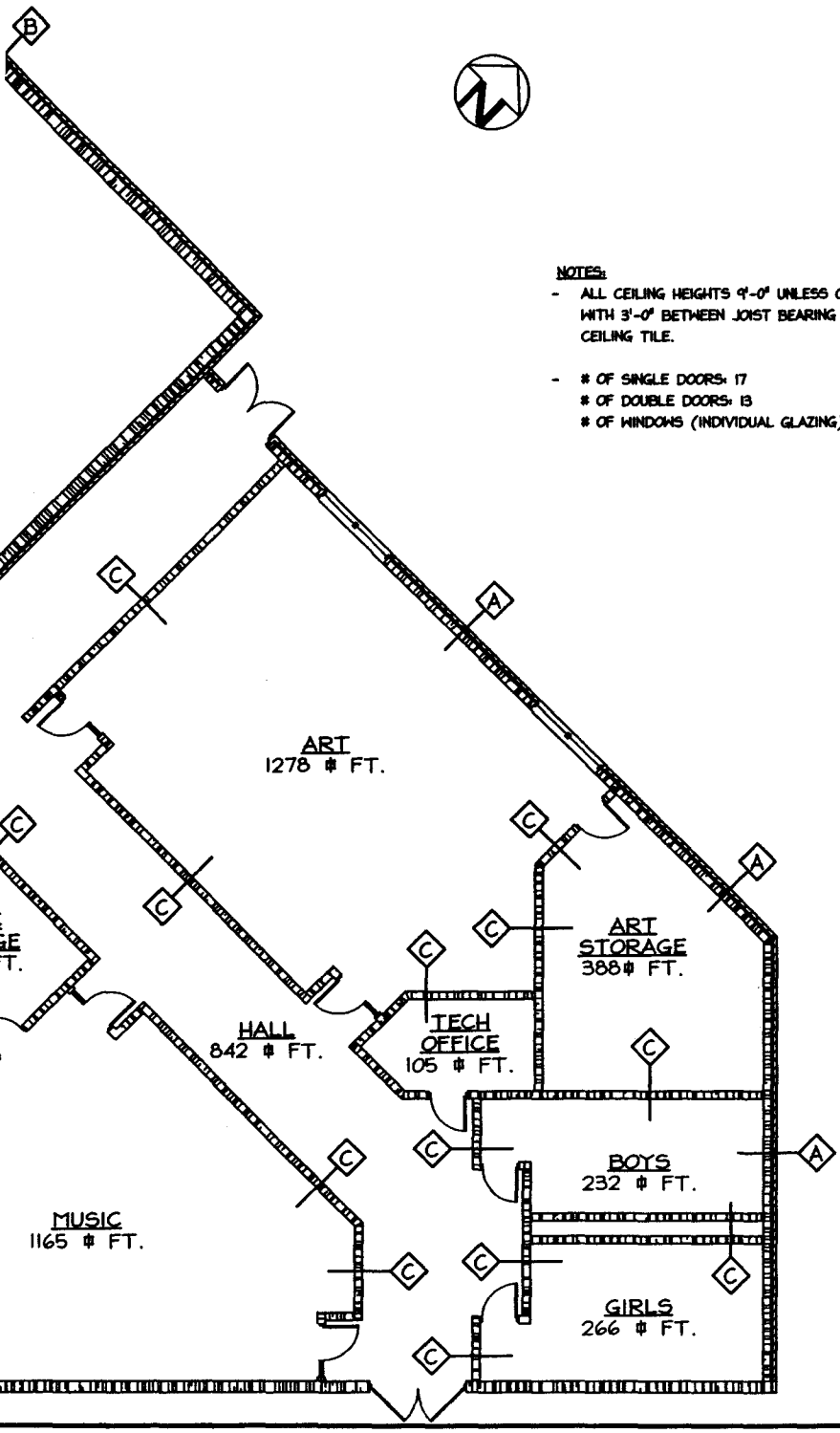
LENNOX® SOLUTIONS YOU CAN TRUST.®



P:/HVAC/DESIGN.DWG

WALL TYPES:

- (A) 1'-2" WALL: 3⅝" FACE BRICK, 2" INSULATION, ¾" GYPSUM BOARD SHEATHING, 7⅝" CONCRETE MASONRY UNITS
- (B) 1'-6" WALL: 3⅝" FACE BRICK, 2" RIGID INSULATION, ¾" GYPSUM BOARD SHEATHING, 11⅝" CONCRETE MASONRY UNITS
- (C) 11⅝" CONCRETE MASONRY UNITS
- (D) 7⅝" CONCRETE MASONRY UNITS



NOTES:

- ALL CEILING HEIGHTS 9'-0" UNLESS OTHERWISE NOTED, WITH 3'-0" BETWEEN JOIST BEARING & SUSPENDED CEILING TILE.
- # OF SINGLE DOORS: 17
  # OF DOUBLE DOORS: 13
  # OF WINDOWS (INDIVIDUAL GLAZING): 11

FLOOR PLAN
1/16" = 1'-0"

NO.	REVISION	DATE	BY

ME 7501
ADVANCED
HVAC DESIGN

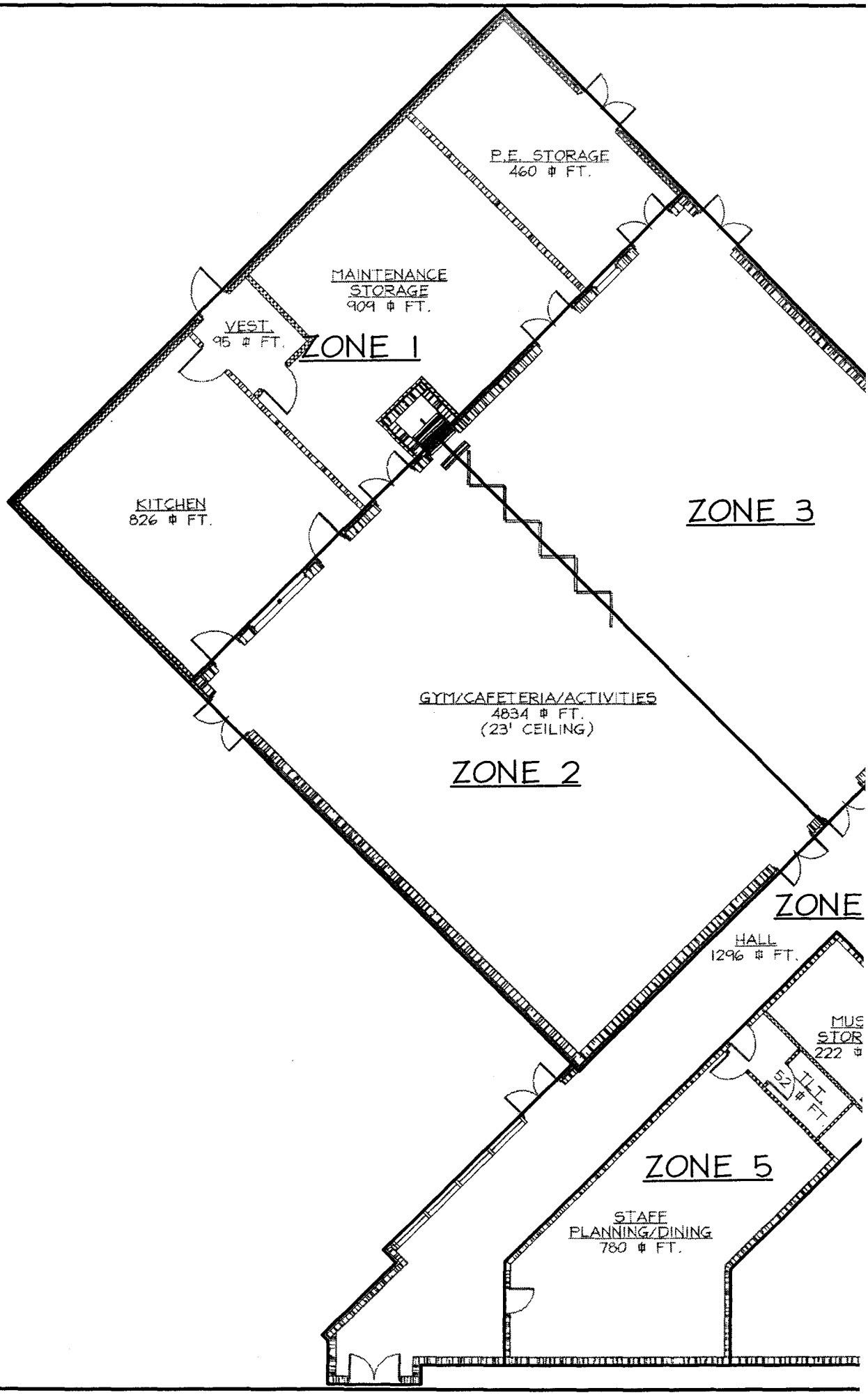
USD 305
SUNSET ELEMENTARY SCHOOL
ADDITION
FLOOR PLAN
MECHANICAL HVAC

DESIGN
SEAN MILLER
KOSUKE ISHIKAWA
SHAWN BEAL

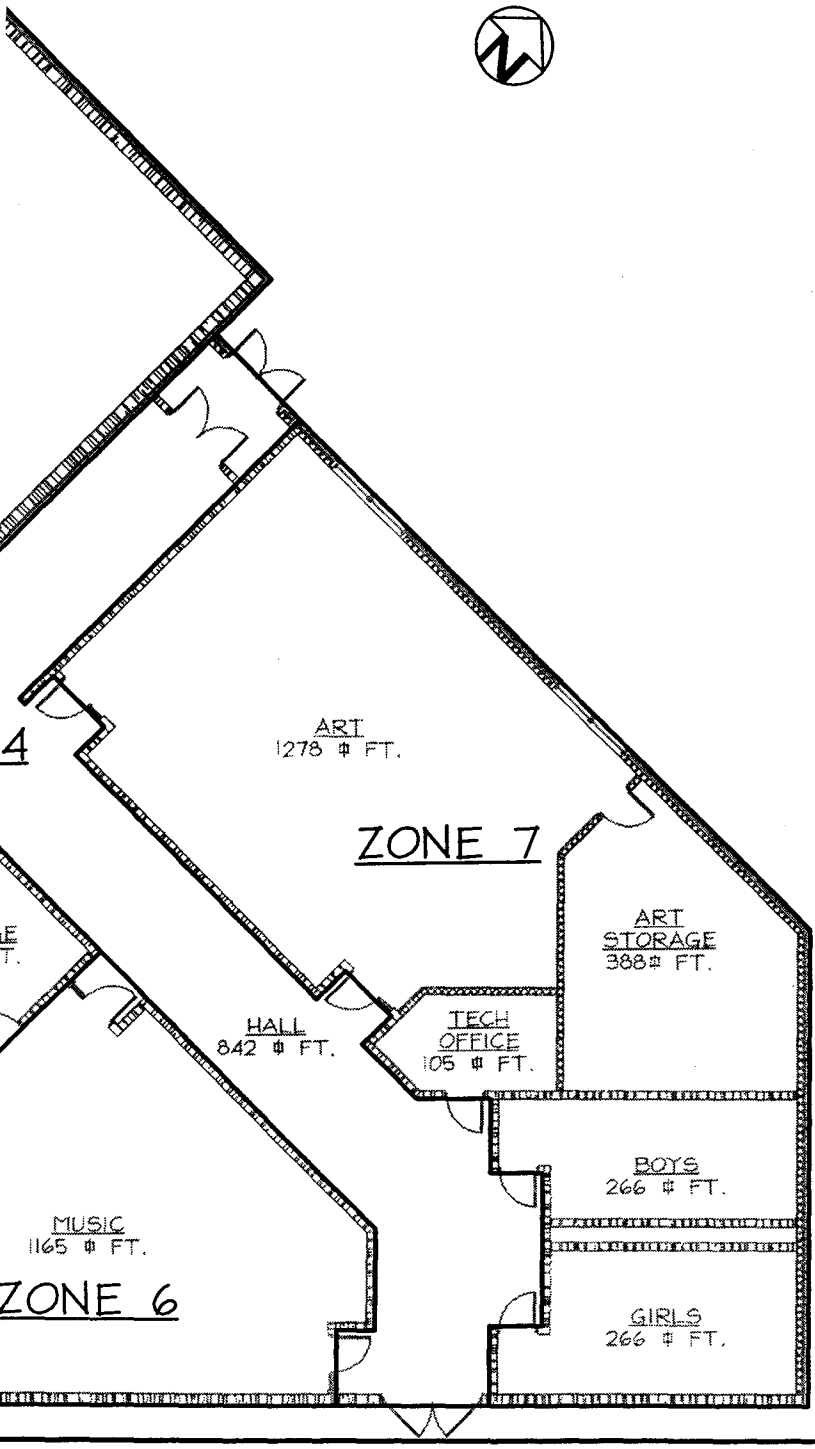
DATE
DECEMBER 10, 2001

SUBMITTAL
FINAL REPORT

SHEET NO.
FIG. 1



P:/HVAC/DESIGN.DWG



ZONE PLAN
1/8" = 1'-0"

NO.	REVISION	DATE	BY

ME 7501
ADVANCED
HVAC DESIGN

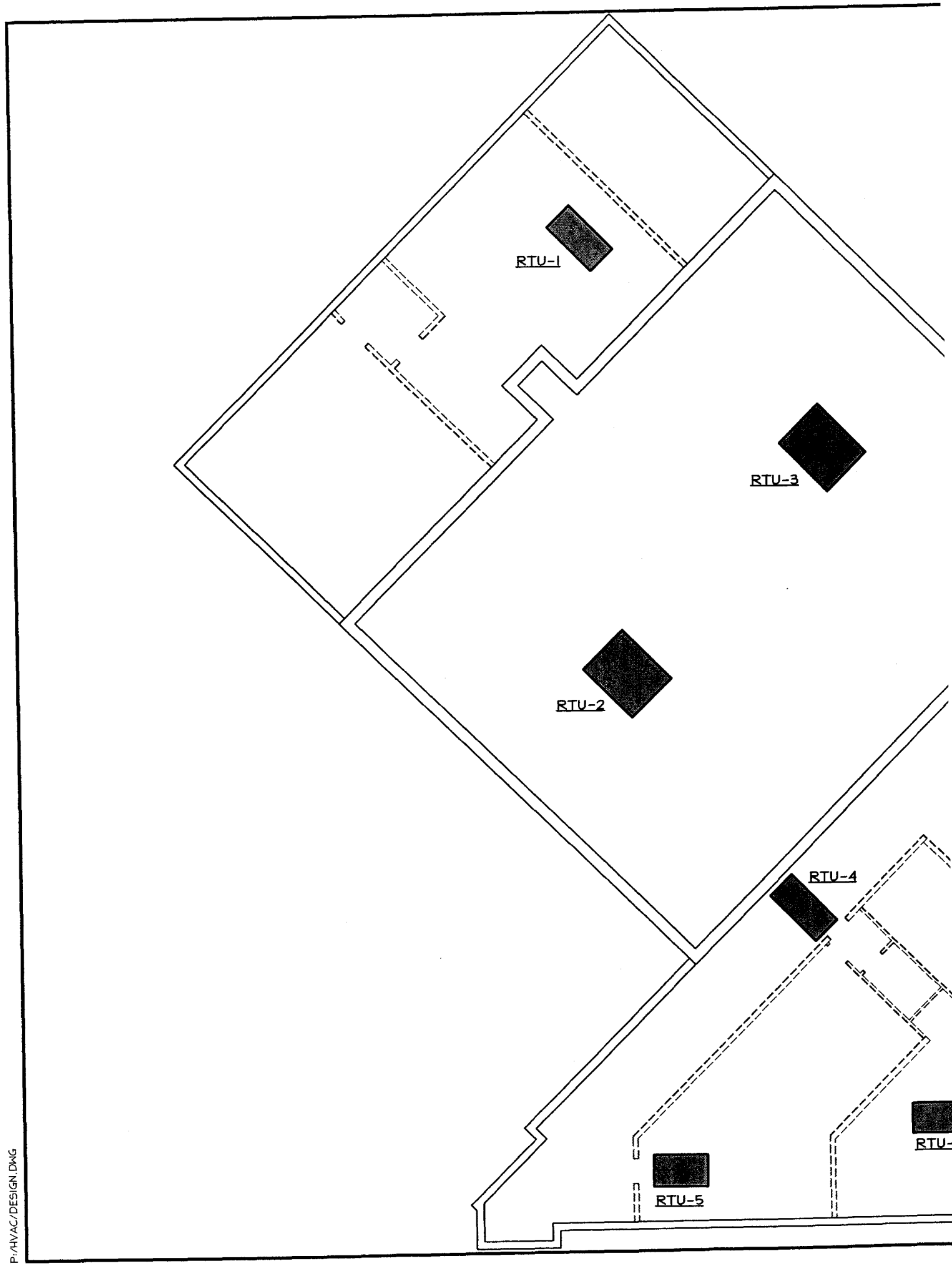
USD 305
SUNSET ELEMENTARY SCHOOL
ADDITION
ZONE PLAN
MECHANICAL HVAC

DESIGN
SEAN MILLER
KOSUKE ISHIKAWA
SHAWN BEAL

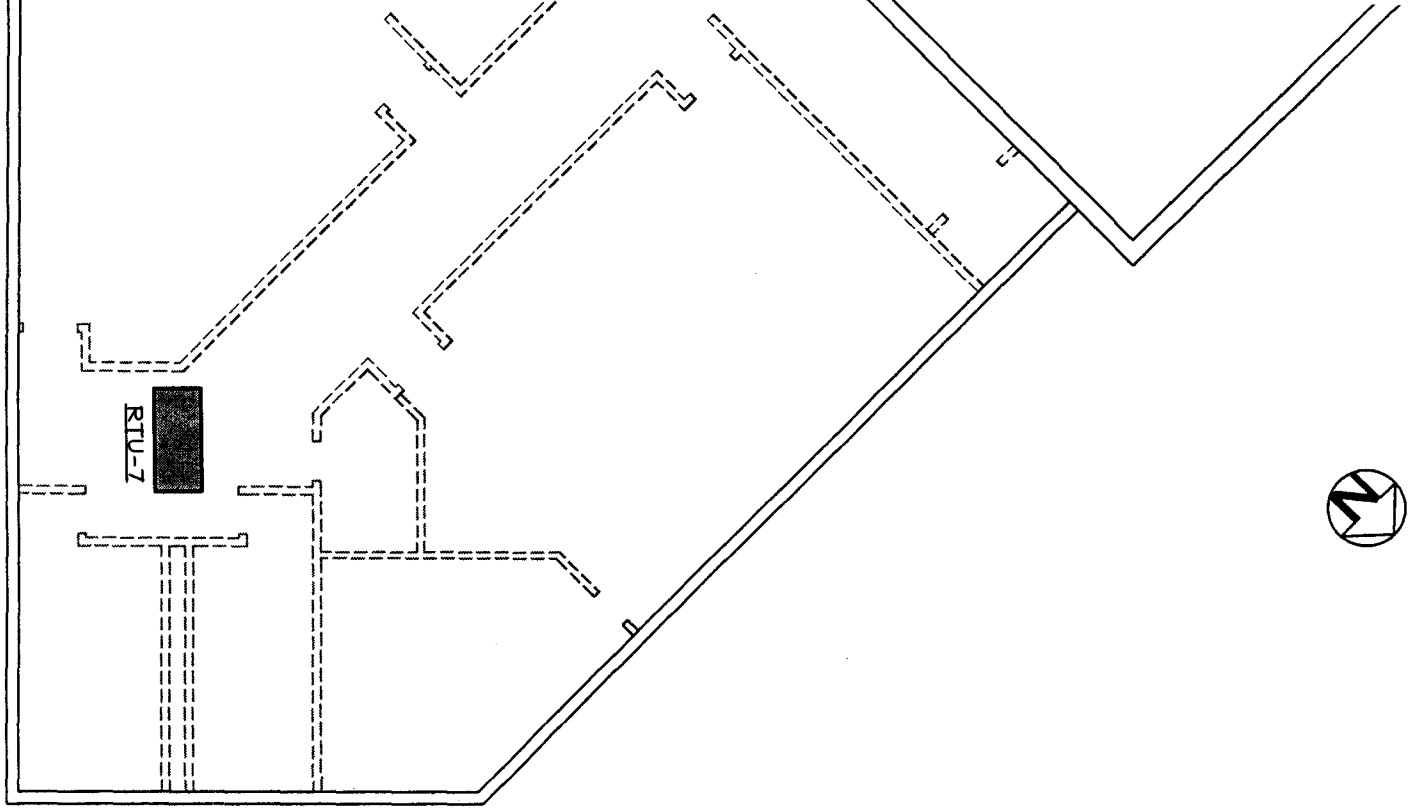
DATE
DECEMBER 10, 2001

SUBMITTAL
FINAL REPORT

SHEET NO.
FIG. 2



P:/HVAC/DESIGN.DWG



ROOF TOP UNIT PLAN

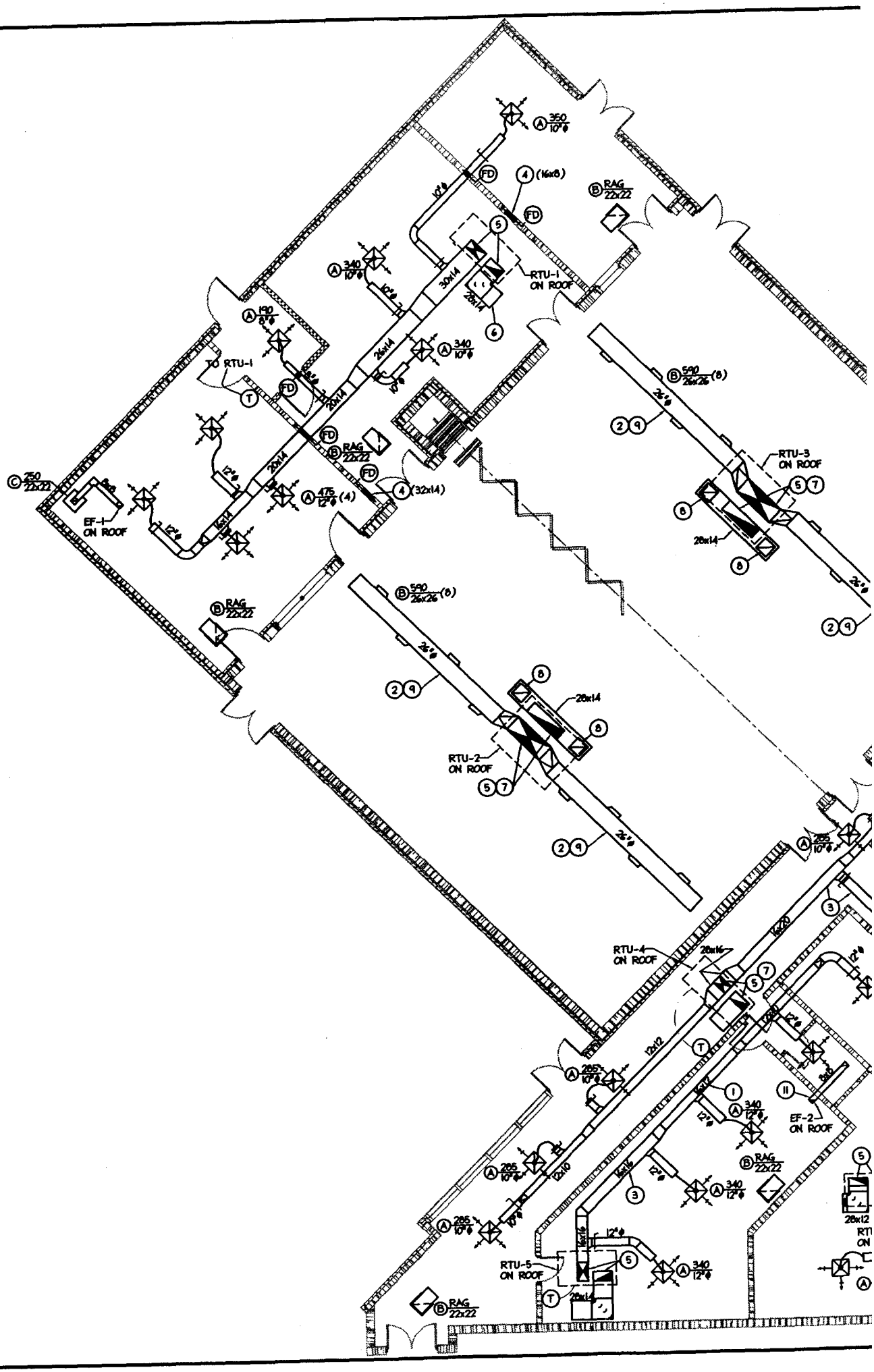
1/4" - 1'-0"

SHEET NO.	FIG. 3
SUBMITTAL	INTERIM REPORT
DATE	OCTOBER 26, 2001
DESIGN	SEAN MILLER KOSUKE ISHIKAWA SHAWN BEAL

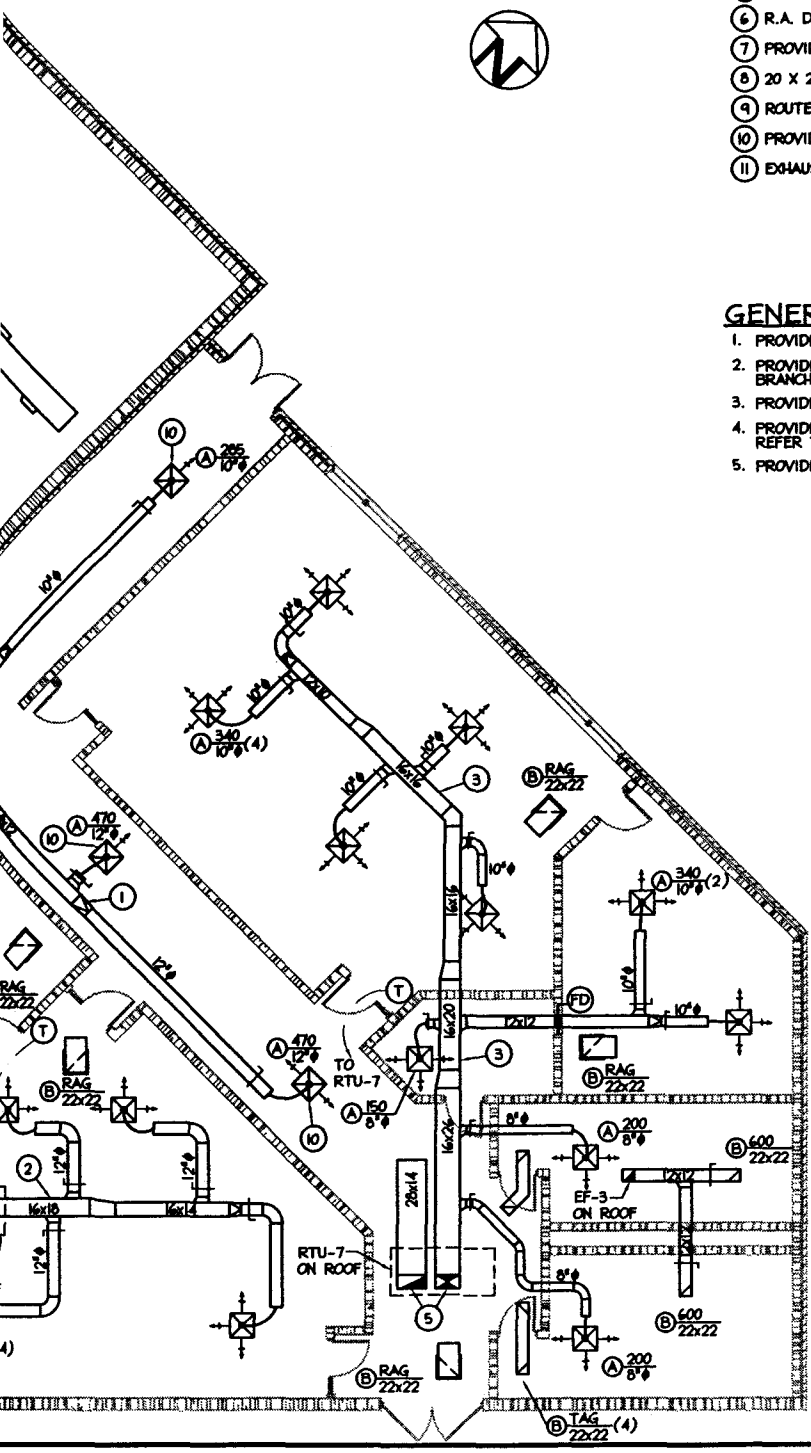
USD 305
SUNSET ELEMENTARY SCHOOL
ADDITION
ROOF TOP UNIT PLAN
MECHANICAL HVAC

ME 7501
ADVANCED
HVAC DESIGN

NO.	REVISION	DATE	BY



P:/HVAC/DESIGN.DWG



PLAN NOTES

1. SQUARE TO ROUND TRANSITION. (TYP)
2. ROUTE DUCT IN JOIST SPACE.
3. ROUTE DUCT TIGHT TO BOTTOM OF JOIST.
4. TRANSFER AIR OPENING IN WALL ABOVE.
5. S.A. AND R.A. DUCTS UP TO UNIT. TRANSITION AS REQUIRED.
6. R.A. DUCT OPEN ABOVE CEILING.
7. PROVIDE 50/50 SPLITTING TEE WITH TURNING VANES.
8. 20 X 20 OPENING IN TOP OF R.A. DUCT.
9. ROUTE DUCT CENTERED BETWEEN JOISTS.
10. PROVIDE SECTORIZING BAFFLES IN DIFFUSER TO PROVIDE THROW INDICATED.
11. EXHAUST DUCT UP TO FAN ON ROOF, TRANSITION AS REQUIRED.

GENERAL NOTES

1. PROVIDE TURNING VANES IN ALL RECTANGULAR ELBOWS AND OFFSETS, (TYP).
2. PROVIDE 45° HI-EFF. TAKEOFF FITTINGS WITH MANUAL VOLUME DAMPER ON ALL BRANCH TAKEOFFS TO DIFFUSERS. REFER TO DETAIL, FIGURE 6.
3. PROVIDE FLEXIBLE CONNECTION AT ALL MECHANICAL UNITS.
4. PROVIDE INSULATED SOUND BOOTS ON ALL RETURN AIR GRILLES. REFER TO DETAIL, FIGURE 6.
5. PROVIDE ACCESS DOORS FOR ALL FIRE DAMPERS.

DUCT LAYOUT PLAN

1/8" = 1'-0"

NO.	REVISION	DATE	BY

ME 7501
ADVANCED
HVAC DESIGN

USD 305
SUNSET ELEMENTARY SCHOOL
ADDITION
SCHEMATIC DUCT LAYOUT PLAN
MECHANICAL HVAC

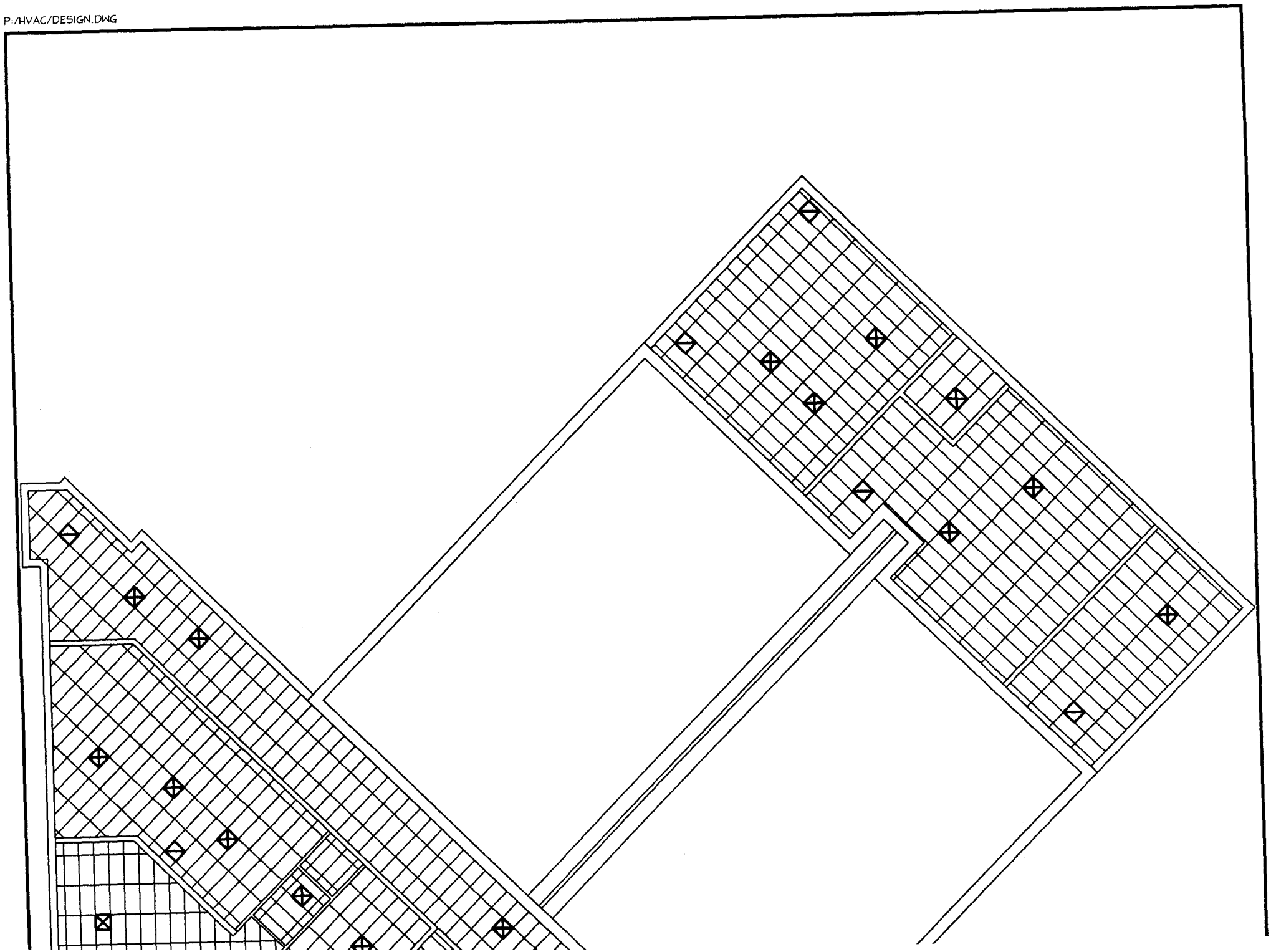
DESIGN
SEAN MILLER
KOSUKE ISHIKAWA
SHAWN BEAL

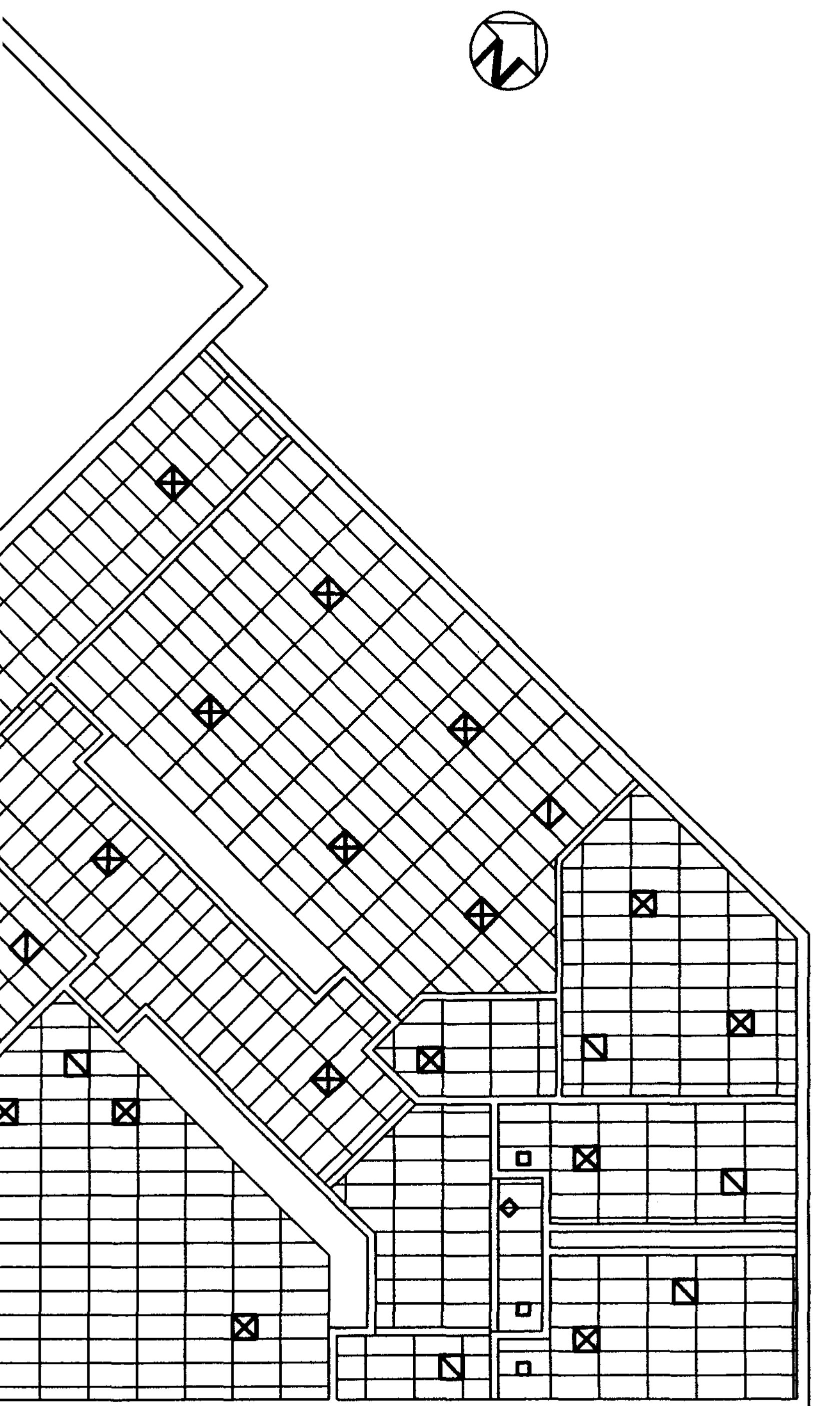
DATE
DECEMBER 10, 2001

SUBMITTAL
FINAL REPORT

SHEET NO.
FIG. 4

P:/HVAC/DESIGN.DWG





PLAN NOTES

- SUPPLY AIR DIFFUSERS
- RETURN AIR GRILLES
- TRANSFER AIR GRILLES

DIFFUSER PLAN
1/16" = 1'-0"

NO.	REVISION	DATE	BY

ME 750I ADVANCED HVAC DESIGN

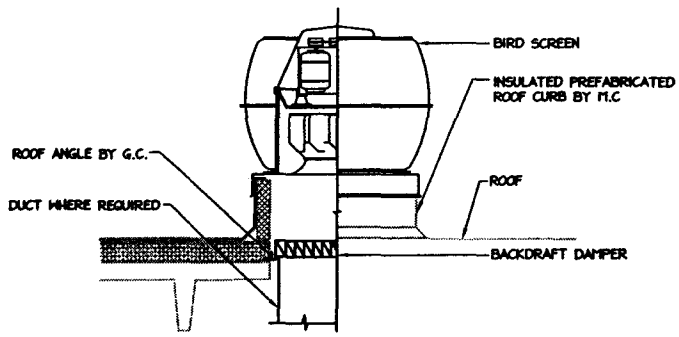
USD 305
SUNSET ELEMENTARY SCHOOL
ADDITION
DIFFUSER LAYOUT PLAN
MECHANICAL HVAC

DESIGN
SEAN MILLER
KOSUKE ISHIKAWA
SHAWN BEAL

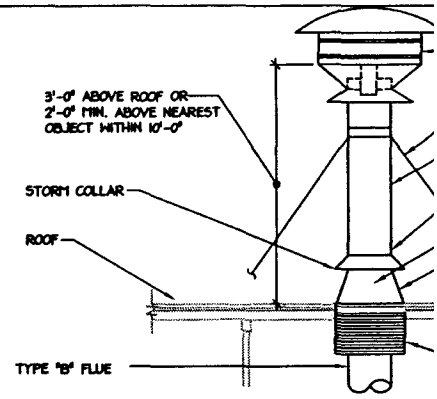
DATE
DECEMBER 10, 2001

SUBMITTAL
FINAL REPORT

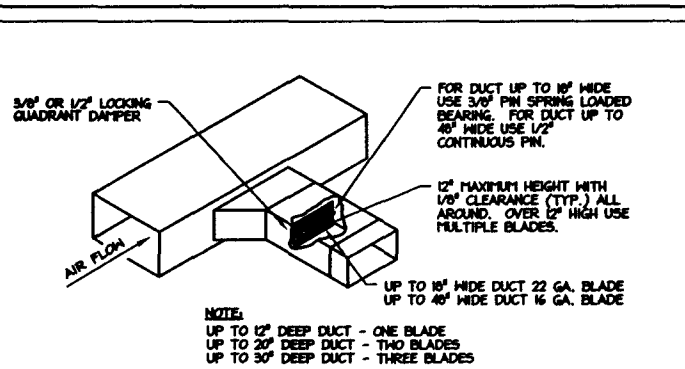
SHEET NO.
FIG. 5



EXHAUST FAN DETAIL
NOT TO SCALE



FLUE THRU ROOF
NOT TO SCALE



RECTANGULAR DUCT TAKE-OFF
NOT TO SCALE

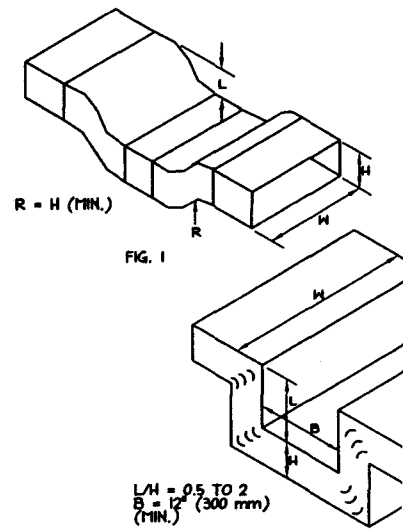
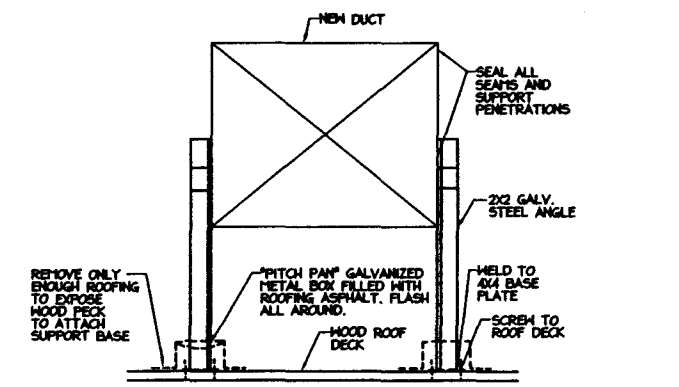
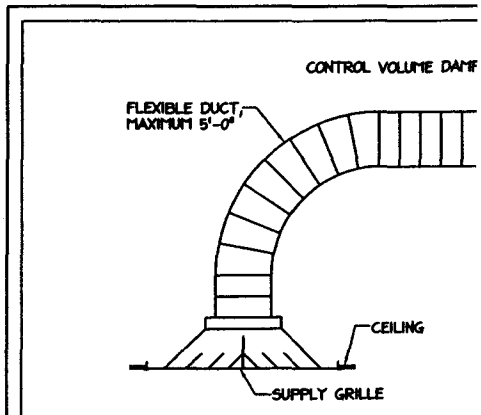


FIG. 3

DUCT UNDER BI
NOT TO SCAL

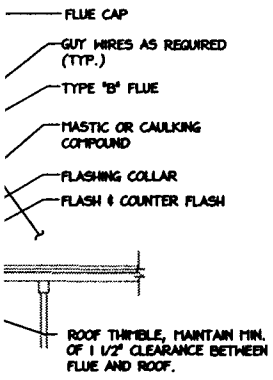


DUCT SUPPORT DETAIL
NOT TO SCALE

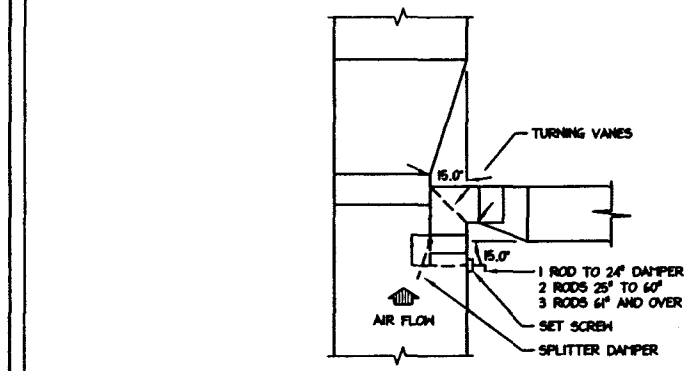


CEILING DIFFU
NOT TO SCALE

P:/HVAC/DESIGN.DWG



ETAIL



MAIN BRANCH TAKE-OFF
NOT TO SCALE

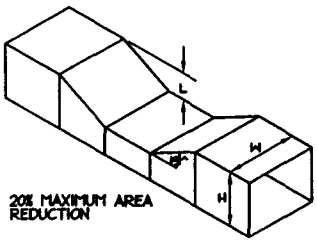
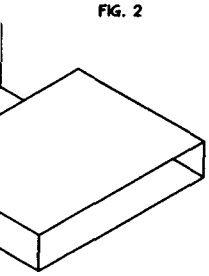
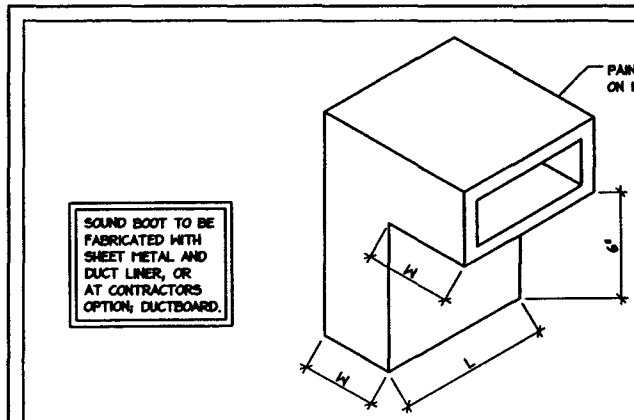


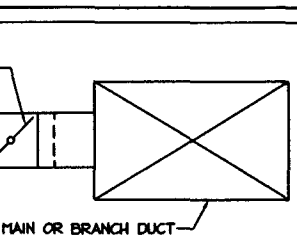
FIG. 2



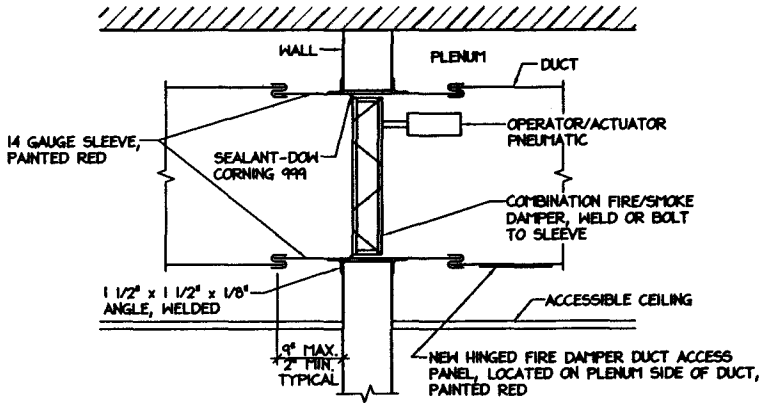
AM DETAIL



SOUND TRAP
NOT TO SCALE



ER DETAIL



COMBINATION FIRE/SMOKE DAMPER DETAIL
NOT TO SCALE

NO.	REVISION	DATE	BY

ME 7501
ADVANCED HVAC DESIGN

USD 305
SUNSET ELEMENTARY SCHOOL
ADDITION
MISCELLANEOUS DETAILS
MECHANICAL HVAC

DESIGN
SEAN MILLER
KOSUKE ISHIKAWA
SHAWN BEAL

DATE
OCTOBER 26, 2001

SUBMITTAL
INTERIM REPORT

SHEET NO.
FIG. 6