9 Piping

Currently, because of hot water reheat, there is hot water supply (HWS) and return (HWR) to each VAV unit. After checking the HW piping in the original plans, the pipe size is adequate to accommodate the HW to the radiant panels[d]. For a DOAS system, we will have to add chilled water supply (CWS) and return (CWR) to each zone. These pipes will follow the same path as the HW, but will have to be larger as the CWS is much larger than HWS (225 GPM vs 45 GPM).

Table 9.1. Chilled water pipe sizing and head

Section	GPM	Pipe Size[d]	Head/100' (ft H_20)[d]	Length (ft)	Fitting equiv Length (ft)	Total Length(ft)	Total Head (ft H_20)
1	110.4	3.5"	1.6	71	19.25	90.25	1.44
2	90.7	3.5"	1.2	125	25.09	150.08	1.80
3	68.7	3"	1.2	35	15.0	50.00	0.60
4	25.2	2"	1.5	16	3.33	19.33	0.29
5	20	2"	1	39	6.67	45.67	0.46
6	14.4	1.5"	2	16	2.63	18.63	0.37
7	6.4	1.25"	1.3	22	0	22.00	0.29
					TOTAL	395.96	**5.25**
						x2 for return	5.25
						Panel Head[1]	3.00
						Chiller	18.2
						Authority Factor	x2
						Static Head	35
						TOTAL HEAD	**98.4**

[1]See Table 11.1.4 for panel head calculations

10 AHU and Ductwork

Since the total building CFM reduces to only ventilation air, the AHU and ductwork both can be downsized. Reduction in size produces a significant savings in first cost. Cost details are described in Section 14.

The size of an AHU is almost solely based on the CFM. Lowering CFM will also lower everything from fan HP to weight. Since supply air is constant, the fan does not need to be a variable speed drive. All of this will save on first cost. The following table compares the original air handler to the redesigned AHU. The difference in size is very noticeable.

Table 10.1. AHU comparison

	CFM	Fan Drive	Fan Power	Weight	Dimensions
Original	35,800	VFD	50 HP[e]	16,000 lbs[e]	414”x166”x120” [e]
Redesign	5110	Constant	7.5 HP[f]	1,180 lbs[f]	110”x52”x48” [f]

DUCTWORK

Next, the ductwork also can be downsized. Smaller duct diameter requires less sheet metal, which becomes another first cost savings (MPS pg 420). Once the ducts are sized, one must check pressure drop for the longest run. The total pressure drop through the system is very important for fan energy calculations. The table and figure below show a sample calculation of duct sizing.

Table 10.2. Duct sizes and pressure drops

CFM	Duct	FPM	ΔP/100’[d]	Length	ΔP”
3360	18”	1950	0.26	25	0.065
2150	14”	2000	0.37	20	0.074
1150	12”	1500	0.26	38	0.099
690	9”	1600	0.4	12	0.048
490	8”	1400	0.38	11	0.042
430	8”	1250	0.3	10	0.030
170	5”	1150	0.45	15.5	0.070
85	4”	950	0.44	15.5	0.068
30	4”	450	0.15	23	0.035
		FITTINGS			
Description		**C**	**FPM**	**ΔP”**	
Tee		0.5	1950	0.119	
Division tee		0.15	1500	0.021	
Tee		0.13	1500	0.018	
Tee		0.13	1500	0.018	
elbow		0.26	1500	0.036	
transition		0.12	1600	0.019	
Div tee		0.13	1600	0.021	
Div tee		0.13	1250	0.013	
tee		0.52	1250	0.051	
Div tee		1.8	950	0.101	
			TOTAL FOR DUCTS	**0.947**	
AHU				1.3	
Terminal unit				0.05	
Diffuser				0.1	
			TOTAL PRESSURE DROP	**2.397**	

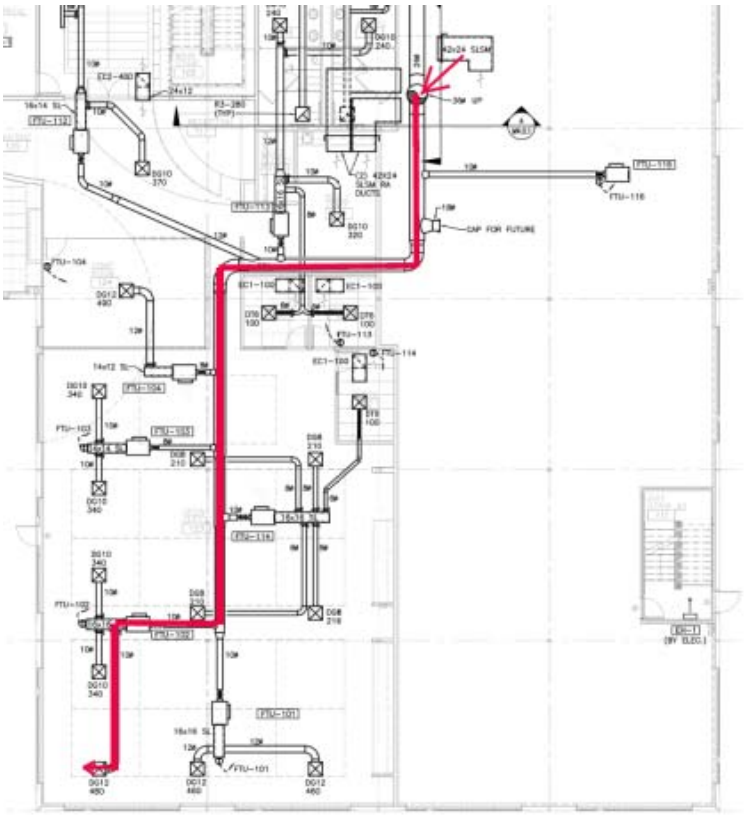

Figure 10.1. Design Duct Run