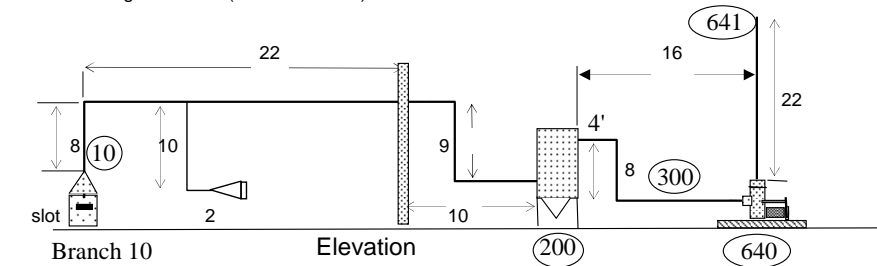


Select duct diameters and compute fan and system pressures (including hood static pressure, SPH) for each of the following conditions (fill in the blanks):

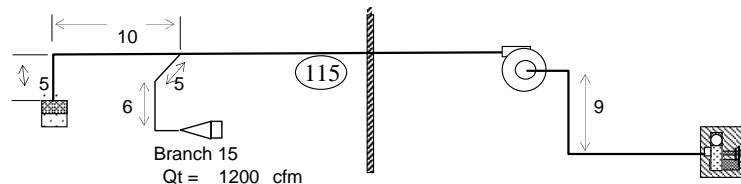


Branch 10
 Qt = 3000 cfm
 3" x 36" slot

Specifications

Hoods: Rectangular 45deg
 Elbows: radius = 2.5D, 5 sections
 Junctions: 30 deg entry
 $\epsilon = 8.5E-04$ ft for all ducts
 Vt = 4500 ft/min
 Baghouse SP= 2 "wg @ 2400 cfm
 Flanged duct takeoff from baghouse
 Drive efficiency = 89%
 Fan efficiency peaks at 66%

All ducts either level with or perpendicular to the ground



Branch 15
 Qt = 1200 cfm

Plan View

Problem No. 1

Run	Type	Dt	D	Qt	Qcorr	Vt	V	VPt	VPcor	Fh	Vslot	SPslot	L	ϵ	Nel	Fel	Fi	Fmisc	Fen	Angle	CFsum	SPcf	SPoth	SPpath	SPJ	SPbr	K	SPK	SP _{main}	SPh
10	Branch	11.1	10	3000	3243	4500	5500	1.89	2.2	0.25	4000	1.776	23.0	9.E-04	2	0.17	2.44	0	-0.08	0	2.07	-3.90	0	-5.68	-6.64	-6.64	0.10		4.83	
15	Branch	7.0	6	1200	1200	4500	6112	2.33	2.33	0.25	0	0	23.0	9.E-04	2.5	0.17	4.62	0	0.11	30	2.85	-6.64	0	-6.64	-6.64	-6.64	0.15		2.91	

Assume $D_m = 0.5 \cdot \text{INT}(2 \cdot (D_a^2 + D_b^2))^{0.5} = 10$

$Q_{corr} = Q_t \cdot (SP_J / SP_{req})^{0.5}$ $SPh = VP_{final} \cdot (1 + F_h) + SP_{slot} \cdot (Q_{corr} / Q_t)^2 + SP_{oth}$ $VP_{slot} = 1.78 \text{ df } (V_{slot} / 4005)^2$

115	Main	13.5	12	4443		4500	5657	1.99			0	0	0	19.0	9.E-04	2	0.17	1.95	0	0.00	0	0.71	-1.42	0	-7.78	-6.64	0.15	0.27	-6.64	0.00
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$SP_k = \frac{K_a Q_a V P_a + K_b Q_b V P_b}{Q_a + Q_b}$

Qa+Qb

200	Baghouse		12	4443																											3.702	-10.34
300	Main	18.1	18	4443		2500	2514	0.39		0.5	0	0	33.0	9.E-04	3	0.17	1.22	0	0.00	0	2.413	-0.95	0	-0.95	0.00	0.15		-11.29	0.00			
Fan	Fan	18.1	18	4443		2500	2514	0.39		0	0	0	0.0		0	0	0.92	0	0.00	0	0	0.00	0	0.00	0.00	0.15		-11.29	0.00			
641	Main	18.1	18	4443		2500	2514	0.39		0	0	0	22.0	9.E-04	0	0.17	1.22	0	0.00	0	0.268	-0.11	0	-0.11	0.00	0.15		0.11	0.00			

Fan TP = SP_{out} + VP_{out} - (SP_{in} + VP_{in})
 = 0.11 + 0.39 - (-11.29 + 0.394)
 = 11.4 "w.g.

$$\text{PowerAir} = \frac{Q \text{ FanTP}}{6356} = \frac{4443 \cdot 11.39}{6356} = 7.96 \text{ HP}$$

$$\text{PowerMotor} = \frac{\text{PowerAir}}{\text{Eff}_{\text{drive}}} = \frac{7.96 \text{ HP}}{89\%} = 8.95 \text{ HP, round to } 10\text{HP}$$

$$\text{PowerElectrical} = \text{PowerMotor} \cdot 8.95 \text{ HP} = 13.56 \text{ HP or } 10.1 \text{ kw} \quad \color{red}{1 \text{ HP to } 0.746 \text{ kw}}$$