

✳️ This software pack includes a program and a key. Open eDUCT file in CD, click SETUP and follow the steps to finish installation. Then desktop will exist eDUCT execution file. (2024/6/27)

enhanced DUCT Design Software (eDUCT) Manual

★ To compute (total) pressure loss, duct size, fan horsepower, etc.

★ To verify Moody chart, Darcy equation and Colebrook equation, etc.

(A) Symbols:

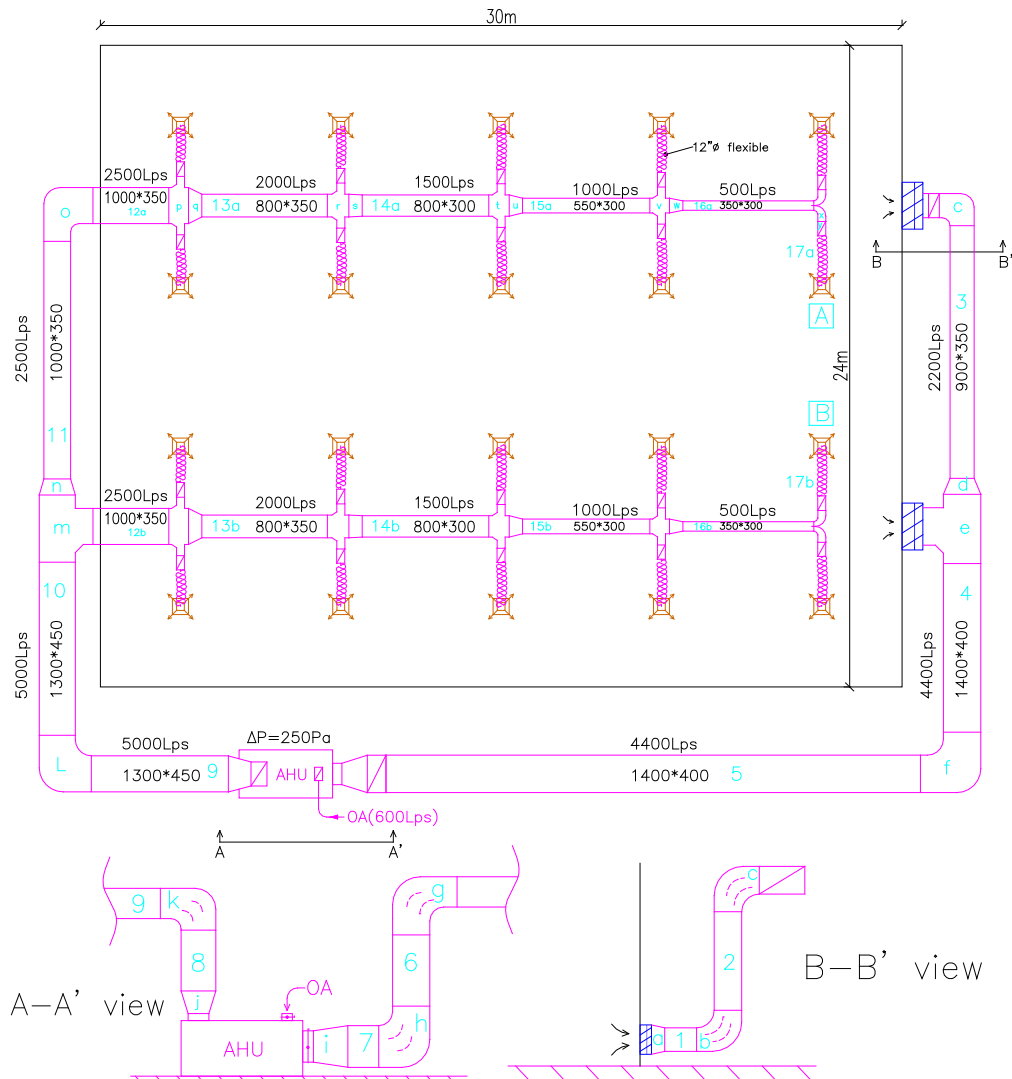
FN : fitting No.	ν : kinematic viscosity(m ² /s)	P_f : fitting pressure loss(Pa, =Cs*P _v)
SN : serial No.	ϵ/D : relative roughness (-)	P_m : main duct pressure loss(Pa, = $\Delta P_f \cdot L$)
Q : flowrate(L/s)	Re : Reynolds No. (-)	P_t : total pressure loss(Pa, =P _f +P _m)
V : velocity(m/s)	f : friction factor(-)	P_r : fan total pres. (Pa)
ϵ : absolute roughness(mm)	Cs : fitting loss coefficient(-)	P_s : fan static pres. (Pa)
T : temperature(°Cdb)	H : given duct height(mm)	θ_f : fan total pres. eff.
RH : relative humidity(%RH)	W : specified duct width(mm)	θ_{fs} : fan static pres. eff.
ρ : density (kg/m ³)	L : duct length(m)	θ_m : motor eff.
P _v : velocity pressure(Pa)	R _{as} : aspect ratio(W/H ≤ 5)	θ_b : belt eff.
ΔP_f : friction loss(Pa/m)	A _s : duct area(m ² , =(H+W)×L×2.03)	$\theta_b=1.0$ if no belt is used.
D : duct diameter(mm)	De : equivalent diameter of rectangular duct(mm)	

(B) Hints for ρ (kg/m³) and ϵ (mm):

- (1) Standard air (20°C & 0%RH or (ρ)1.204 kg/m³) is normally adopted for common HVAC ducts.
- (2) common ϵ values : PVC(0.04) , galvanized steel round(0.09) , galvanized steel spiral(0.12) , flexible aluminum, 100% extended(2.0)
- (3) other ρ and ϵ values can be found by visiting public websites.

(C) Duct Diagram Example (✳️ Refer to eDUCT Software in fig 2.)

- (1) Number each straight duct, such as ①②③⋯. Mark each fitting, such as a b c ⋯.
- (2) Usually the longest path (path A) has the largest friction loss. However, sometimes the shorter branch path B may have larger loss depending on fitting's shape & quantity..



(D) Common Use Fitting Loss Coefficients(Cs)(※approximate values)

★The Cs values in ASHRAE Duct Fitting Database are preferred.

Item	1	2	3	4	5
Fitting	45° elbow	90° elbow	transition	rectangular-round	double 45° elbow
Symbol					
Cs	0.05~0.2(≒0.13)	0.1~0.35(≒0.25)	0.1~0.3(≒0.2)	0.1~0.35(≒0.25)	0.15~0.35(≒0.2)

Item	6	7	8	9	10
Fitting	wye (≤ 30°)	double wye (≤ 30~45°)	2-way junction	Junction w / 2 splitters	dovetail
Symbol					
Cs(main)	0.1~0.35(≒0.25)	0.1~0.35(≒0.25)	0.1~0.35(≒0.25)	0.1~0.35(≒0.25)	0.1~0.25(≒0.15)
Cs(branch)	0.2~0.7(≒0.45)	0.2~0.7(≒0.45)	0.2~0.7(≒0.45)	0.2~0.7(≒0.45)	0.1~0.25(≒0.15)

※(Pink value) can be used for general calculation. For two fittings in one section duct, these two Cs values can add together first and fill into fig4 Cs column.

(E) Operating Steps: (Refer to Computer Screen)

- (1) **fig 1:** Select **New Project** or **Existing file**
- (2) **fig 2:** Select one project and click **OK**
- (3) **fig 3:**
 - ① Input **Customer, Project and Date**
 - ② **Must Inputs:** Input Q、V、ε and T(°C)
Defaults: ε(0.09), T(20) and RH(0.1%).
 - ③ **Option Input:** Input %RH(cannot be 0.00%) or ρ.
Defaults 0.01%RH and ρ(1.204) can be changed.
 - ④ **Remarks:** Input fitting No. & Straight duct No.
 - ⑤ Click **NEXT** or **EXIT**

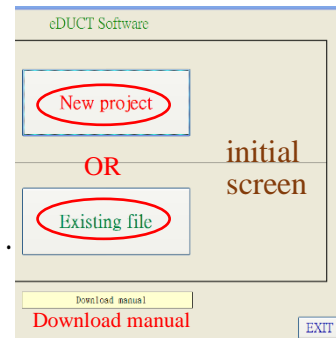


fig1.

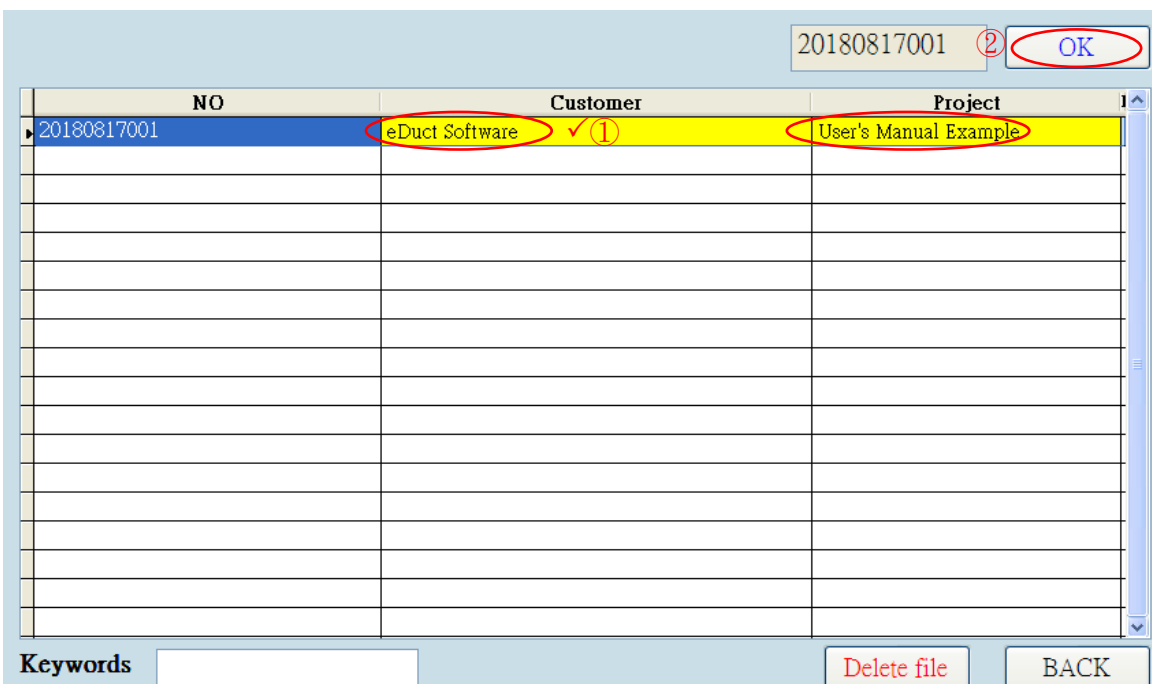


fig 2.

- ⑥ If 「Equal Friction Loss」 method is adopted, like this example, suppose target ΔPL (column 8) is 1.00Pa/m, try to input V value (Column 2) until (column 8) $\Delta PL \doteq 1.00\text{Pa/m}$.
- ⑦ Data in Column 11~13 can be used to verify Corebrook Eq($1/\sqrt{f} = -2\log[0.27(\epsilon/D) + (2.51/Re)\sqrt{f}]$).
- (4) **fig4:** Input Cs, H, W and L; quick double click Cs column and the default values(0.2, 350, 700 and 1.00) will be shown on screen. Default values can be changed. Let $H=D$ if round duct is used. Input duct width (column W) by "trial and error". For example, for SN1(Row 1), input a certain value at W column, such as 800(mm) first and see if De (column De) is equal to D (column D). If it isn't, try another W value (900) until $De(597) \doteq D(592)$. H value is specified by designer. As(m²) is the required duct surface area. $As(m^2) = (H+W)*L*2.03$. 3% is making-loss rate.
 - ※Go back to fig 3 if you want to modify any data in Copied from Table 1 and Remarks.

fig 3.

NO: 20180817001 Customer: eDuct Software ① Project: User's Manual Example Date: 2018/08/17 NEXT ⑤

SN	Must Inputs ②			Option Input ③				Outputs					④ Remarks	
	1 Q L/s	2 V m/s	3 ϵ mm	4 T °C	5 RH %	6 ρ kg/m ³	7 Pv Pa	8 ΔPL Pa/m	9 D mm	10 ν m ² /s	11 ϵ/D	12 Re		13 f
1	2200.0	8.00	0.090	20.0	0.1	1.204	38.5	1.016	592	0.00001508	0.000152	313988.2	0.0156	return grille-1 transition(a)
2	2200.0	8.00	0.090	20.0	0.1	1.204	38.5	1.016	592	0.00001508	0.000152	313988.2	0.0156	elbow (b), SN1-2
3	2200.0	8.00	0.090	20.0	0.1	1.204	38.5	1.016	592	0.00001508	0.000152	313988.2	0.0156	elbow(c), SN2-3
4	4400.0	9.40	0.090	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	transition(d), wye main(e), SN3-4
5	4400.0	9.40	0.090	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	elbow(f), SN4-5
6	4400.0	9.40	0.090	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.74	0.0145	elbow(g), SN5-6
7	4400.0	9.40	0.090	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	elbow(h), SN6-7, transition(i), SN7-AHU
8	5000.0	9.70	0.090	20.0	0.1	1.204	56.6	1.001	810	0.00001508	0.000111	521228.1	0.0143	transition(j), AHU-SN8
9	5000.0	9.70	0.090	20.0	0.1	1.204	56.6	1.001	810	0.00001508	0.000111	521228.1	0.0143	elbow(k), SN8-9
10	5000.0	9.70	0.090	20.0	0.1	1.204	56.6	1.001	810	0.00001508	0.000111	521228.1	0.0143	elbow(l), SN9-10
11	2500.0	8.20	0.090	20.0	0.1	1.204	40.5	1.000	623	0.00001508	0.000144	338870.6	0.0154	wye main(m), transition(n), SN10-11
12	2500.0	8.20	0.090	20.0	0.1	1.204	40.5	1.000	623	0.00001508	0.000144	338870.6	0.0154	elbow(o), SN11-12a
13	2000.0	7.80	0.090	20.0	0.1	1.204	36.6	1.011	571	0.00001508	0.000158	295610.1	0.0158	wye main(p), transition(q), SN12a-13a
14	1500.0	7.30	0.090	20.0	0.1	1.204	32.1	1.021	511	0.00001508	0.000176	247664.6	0.0163	wye main(r), transition(s), SN13a-14a
15	1000.0	6.60	0.090	20.0	0.1	1.204	26.2	1.018	439	0.00001508	0.000205	192277.7	0.0170	wye main(t), transition(u), SN14a-15a
16	500.0	5.50	0.090	20.0	0.1	1.204	18.2	0.992	340	0.00001508	0.000265	124114.7	0.0185	wye main(v), transition(w), SN15a-16a
17	250.0	3.74	2.000	20.0	0.1	1.204	8.4	1.003	292	0.00001508	0.006856	72370.7	0.0347	dovetail(x), rectangular-round(y), SN16a-17a
18	0.0	0.00	0.000	0.0	0.0	0.000	0.00000	0.00000	0.00000	0.000000000	0.0000000	0.0000000	0.0000000	flexible duct($\epsilon = 2.0, D = 300$), SN17a-diffuser
19	0.0	0.00	0.000	0.0	0.0	0.000	0.00000	0.00000	0.00000	0.000000000	0.0000000	0.0000000	0.0000000	★for deleting all inputs
20	0.0	0.00	0.000	0.0	0.0	0.000	0.00000	0.00000	0.00000	0.000000000	0.0000000	0.0000000	0.0000000	
21	0.0	0.00	0.000	0.0	0.0	0.000	0.00000	0.00000	0.00000	0.000000000	0.0000000	0.0000000	0.0000000	

EXIT

fig 4.

BACK NEXT

SN	Copied From Table 1				Inputs				Outputs					Remarks		
	Q L/S	V m/s	Pv Pa	ΔPL Pa/m	D mm	Cs	H mm	W mm	L m	Ras W/H	De mm	As m ²	Pf Pa		Pm Pa	Pt Pa
1	2200.0	8.00	38.5	1.016	592	0.20	350	900	1.00	2.57	597	2.54	7.70	1.00	8.70	return grille-1 transition(a)
2	2200.0	8.00	38.5	1.016	592	0.25	350	900	3.00	2.57	597	7.61	9.60	3.00	12.70	elbow (b), SN1-2
3	2200.0	8.00	38.5	1.016	592	0.25	350	900	12.00	2.57	597	30.45	9.60	12.20	21.80	elbow(c), SN2-3
4	4400.0	9.40	53.2	0.999	772	0.45	400	1400	6.00	3.50	781	21.92	23.90	6.00	29.90	transition(d), wye main(e), SN3-4
5	4400.0	9.40	53.2	0.999	772	0.25	400	1400	24.00	3.50	781	87.70	13.30	24.00	37.30	elbow(f), SN4-5
6	4400.0	9.40	53.2	0.999	772	0.25	400	1400	3.00	3.50	781	10.96	13.30	3.00	16.30	elbow(g), SN5-6
7	4400.0	9.40	53.2	0.999	772	0.45	400	1400	1.00	3.50	781	3.65	23.90	1.00	24.90	elbow(h), SN6-7, transition(i), SN7-AHU
8	5000.0	9.70	56.6	1.001	810	0.20	450	1300	3.00	2.89	808	10.66	11.30	3.00	14.30	transition(j), AHU-SN8
9	5000.0	9.70	56.6	1.001	810	0.25	450	1300	6.00	2.89	808	21.32	14.20	6.00	20.20	elbow(k), SN8-9
10	5000.0	9.70	56.6	1.001	810	0.25	450	1300	12.00	2.89	808	42.63	14.20	12.00	26.20	elbow(l), SN9-10
11	2500.0	8.20	40.5	1.000	623	0.45	350	1000	12.00	2.86	626	32.89	18.20	12.00	30.20	wye main(m), transition(n), SN10-11
12	2500.0	8.20	40.5	1.000	623	0.25	350	1000	6.00	2.96	626	16.44	10.10	6.00	16.10	elbow(o), SN11-12a
13	2000.0	7.80	36.6	1.011	571	0.45	350	800	6.00	2.29	567	14.01	16.50	6.10	22.50	wye main(p), transition(q), SN12a-13a
14	1500.0	7.30	32.1	1.021	511	0.45	300	800	6.00	2.67	520	13.40	14.40	6.10	20.60	wye main(r), transition(s), SN13a-14a
15	1000.0	6.60	26.2	1.018	439	0.45	300	550	6.00	1.83	439	10.35	11.80	6.10	17.90	wye main(t), transition(u), SN14a-15a
16	500.0	5.50	18.2	0.992	340	0.45	300	550	6.00	1.83	439	10.35	8.20	6.00	14.10	wye main(v), transition(w), SN15a-16a
17	250.0	3.74	8.4	1.003	292	0.50	275	270	3.00	0.98	298	3.32	4.20	3.00	7.20	dovetail(x), rectangular-round(y), SN16a-17a
18	0.0	0.00	0.0	0.000	0	0.00	0	0	0.00	0.00	0	0.00	0.00	0.00	0.00	flexible duct($\epsilon = 2.0, D = 300$), SN17a-diffuser
19	0.0	0.00	0.0	0.000	0	0.00	0	0	0.00	0.00	0	0.00	0.00	0.00	0.00	★for deleting all inputs
20	0.0	0.00	0.0	0.000	0	0.00	0	0	0.00	0.00	0	0.00	0.00	0.00	0.00	
21	0.0	0.00	0.0	0.000	0	0.00	0	0	0.00	0.00	0	0.00	0.00	0.00	0.00	

Total: 340.20 224.4 116.5 340.9 → Copied to fig 5 automatically

(5) **fig5**: Complete the inputs in **Table 3~Table 5**, and **SAVE** first before **PRINT1** or **PRINT2**.

- ① The calculated $P_{tr}=644\text{Pa}$ is total pressure loss. If you want to calculate static pressure loss (Ps), then $P_s = P_{tr} - P_v \text{ @AHU outlet} = 645 - 57 = 588\text{Pa}$ (see p6/6 Table 2 & 4).
- ② Input fan total pressure (PT). $P_{tr} \leq PT \leq 1.05P_{tr}$ is recommended.
- ③ Input fan static pressure (PS) value if Ps is used. $P_{sr} \leq PS \leq 1.05P_{sr}$ is recommended.
- ④ Input θ_{fs} (static pres. eff.) value if fan static pressure (PS) is used.
- ⑤ Input concerned information in Table 5.
- ⑥ Press SAVE first before Print out.

fig 5

Table 3: Calculate Fan Total (Static) Pressure Required(P_{tr})

$P_{tr} = F1 + F2 + F3 + F4 + F5 + F6 + F7 + F8 + F9 + F10$

$P_{tr} = 341 + 15 + 0 + 30 + 0 + 220 + 0 + 15 + 0 + 23 = 644$

F1: pressure loss, from Table 2	F6: AHU internal pressure loss(120~250Pa)
F2: outlet diffuser(10~25Pa)	F7: Fan unit internal loss(SEF.70~250Pa)
F3: silencer box(150~500Pa)	F8: other 1: return grille(10~25Pa)
F4: volume damper(VD,15~30Pa)	F9: other 2: Fire Damper(FD,20~40Pa)
F5: inlet /outlet hood with screen(80~200Pa)	F10:other 3: Extra VD(15~30Pa) → can be changed.

*ASHRAE recommended values & Maker's data are preferred.

Table 4: Calculate Fan Motor Power Required(kW)

$kW_r = \frac{Q * PT \text{ (or PS)}}{1 * 1000000 * \theta_f * \theta_m * \theta_b}$

$5000 * 645 / (1 * 1000000 * 0.55 * 0.88 * 1.00) = 6.66 \text{ kW (8.88 HP)}$

defaults: $0.7 * 0.8 * 0.9$

Ranges of θ_f , θ_m & θ_b *Maker's data are preferred.

Q (L/s)	≤ 1,000	≤ 3,000	≤ 6,000	≤ 12,000	≤ 18,000	≥ 20,000
θ_f	0.42~0.5	0.45~0.55	0.5~0.6	0.55~0.7	0.6~0.75	0.7~0.8
θ_m	0.70~0.85		0.75~0.90		0.87~0.95	
θ_b	0.75~1.0 (=1.0 if no belt is used)					

θ_f : fan total pres. eff., or static pres. eff. θ_{fs} if static pres. is used.
 θ_m : motor eff., θ_b : belt eff., PT: total pres., PS: static pres., $PS = PT - P_v \text{ @fan outlet}$

Table 5: Specify Fan's Specifications

Fan Job	flow rate Q (L/s)	total pres. PT (Pa)	static pres. PS (Pa)	fan eff. θ_f (θ_{fs})	motor eff. θ_m	belt eff. θ_b	motor power kW(HP)	phase / volt / Hz	fan type	remarks
	5000 ⑤	645 ②	---	0.55 ④	0.88 ⑤	1.0 ⑤	7.5(10) ⑤	3/220V/60Hz ⑤	backward ⑤	F class Motor(IE3), SF1.15 ⑤

Designer / Company: Andy Ho/Tempace, Inc. Email: sales.tempace.msa.hinet.net Tel: 886-7-5571755

SAVE PRINT1 PRINT2 EXIT

⑥ (page5/6) (page 6/6)

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We (Tempace, Inc. and developers) have done our best to avoid any errors. However, we do not warrant that the information in this software is error-free. The entire risk as to the quality and performance of this software is with you. In no event shall we be liable to you for any damages and losses, arising out of using this software.

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Table 1 : Duct Basic Analysis Data (eDUCT)

Customer: eDuct Software

Project: User's Manual Example, HV AC system

Date: 2020/04/06

		Must Inputs			Option Input			Outputs			Remarks		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
SN	Q L/s	V m/s	T °C	RH %	ρ kg/m ³	Pv Pa	ΔPL Pa/m	D mm	ν m ² /s	ε/D	Re	f	Noted by Designer FN & SN refer to attached duct diagram
1	22000	8.00	20.0	0.1	1.204	38.5	1.016	592	0.00001508	0.000152	313988.2	0.0156	return grille-1 transition(4)
2	22000	8.00	20.0	0.1	1.204	38.5	1.016	592	0.00001508	0.000152	313988.2	0.0156	elbow (4), SN 1-2
3	22000	8.00	20.0	0.1	1.204	38.5	1.016	592	0.00001508	0.000152	313988.2	0.0156	elbow(4), SN 2-3
4	44000	9.40	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	transition(4), wye main(4), SN 3-4
5	44000	9.40	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	elbow(4), SN 4-5
6	44000	9.40	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	elbow(4), SN 5-6
7	44000	9.40	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	elbow(4), SN 6-7, transition(4), SN 7-AHU
8	50000	9.70	20.0	0.1	1.204	56.6	1.001	810	0.00001508	0.000111	521228.1	0.0143	transition(4), AHU-SN8
9	50000	9.70	20.0	0.1	1.204	56.6	1.001	810	0.00001508	0.000111	521228.1	0.0143	elbow(4), SN 8-9
10	50000	9.70	20.0	0.1	1.204	56.6	1.001	810	0.00001508	0.000111	521228.1	0.0143	elbow(4), SN 9-10
11	25000	8.20	20.0	0.1	1.204	40.5	1.000	623	0.00001508	0.000144	338870.6	0.0154	wye main(m), transition(4), SN 10-11
12	25000	8.20	20.0	0.1	1.204	40.5	1.000	623	0.00001508	0.000144	338870.6	0.0154	elbow (4), SN 11-12a
13	20000	7.80	20.0	0.1	1.204	36.6	1.011	571	0.00001508	0.000158	295610.1	0.0158	wye main(4), transition(4), SN 12a-13a
14	15000	7.30	20.0	0.1	1.204	33.1	1.021	511	0.00001508	0.000176	247664.6	0.0163	wye main(4), transition(4), SN 13a-14a
15	10000	6.60	20.0	0.1	1.204	26.2	1.018	439	0.00001508	0.000205	192277.7	0.0170	wye main(4), transition(4), SN 14a-15a
16	500.0	5.50	20.0	0.1	1.204	18.2	0.992	340	0.00001508	0.000265	124114.7	0.0185	wye main(4), transition(4), SN 15a-16a
17	250.0	3.74	20.0	0.1	1.204	8.4	1.003	292	0.00001508	0.006856	72370.7	0.0347	downlead(x), rectangular-round (4), SN 16a-17a
18													flexible duct(ε =2 Ω, D=300), SN 17a-diffuser
19													
20													
21													

Note 1: Standard air (20°C & 0%RH or 1.204 kg/m³) is normally adopted for common HVAC ducts.

Note 2: common ε values : PVC(0.04) , galvanized steel round(0.09) , galvanized steel spiral(0.12) , flexible aluminium, 100% extruded(0.0)

Note 3: Symbols in Table 1 ~ Table 5 :

- FN : fitting No. SN : serial No. Q : flow rate (L/s) V : velocity (m/s) ε : absolute roughness (mm) T : temperature (°C) RH : relative humidity (%RH)
- P : density (kg/m³) Pv : velocity pressure (Pa) ΔPL : friction loss (Pa/m) D : diameter (mm) ν : kinematic viscosity (m²/s)
- ε/D: relative roughness (-) Re : Reynolds No. () f : friction factor() Cs : section fitting loss coefficient() H : known duct height (mm)
- W : specified duct width (mm) L : duct length (m) Reas : aspect ratio (W/H ≤ 5) De : equivalent diameter of rectangular duct Δs : duct surface area (m²) = (H + W) * L * 2.02)
- Pf : fitting pressure loss (Pa) = Cs * Pv Pm : main duct pressure loss (Pa) = ΔPL * L Pt : total pressure loss (Pa) = Pf + Pm PT : fan total pressure (Pa)
- PS : fan static pressure (Pa) θ f : fan total pressure eff. θ b : belt eff. Q : specified flow rate (L/s)

Table 2 : Duct Size & Utmost Duct Pressure Loss (eDUCT)

SN	Copied From Table 1																Outputs				Remarks
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
	Q L/s	V m/s	Pv Pa	ΔPL Pa/m	D m.m	Cs	H mm	W mm	L m	Ras W/H	De mm	As m ²	Pf Pa	Pm Pa	Pt Pa						
1	22000	8.00	38.5	1.016	592	0.20	350	900	1.00	2.57	597	2.50	7.7	1.0	8.7	return grille-1 transition(θ)					
2	22000	8.00	38.5	1.016	592	0.25	350	900	3.00	2.57	597	7.60	9.6	3.0	12.7	elbow (θ), SN1-2					
3	22000	8.00	38.5	1.016	592	0.25	350	900	12.00	2.57	597	30.50	9.6	12.2	21.8	elbow (θ), SN2-3					
4	44000	9.40	53.2	0.999	772	0.45	400	1400	6.00	3.50	781	21.90	23.9	6.0	29.9	transition(d), wye main(θ), SN 3-4					
5	44000	9.40	53.2	0.999	772	0.25	400	1400	24.00	3.50	781	87.70	13.3	24.0	37.3	elbow (θ), SN 4-5					
6	44000	9.40	53.2	0.999	772	0.25	400	1400	3.00	3.50	781	11.00	13.3	3.0	16.3	elbow (θ), SN 5-6					
7	44000	9.40	53.2	0.999	772	0.45	400	1400	1.00	3.50	781	3.70	23.9	1.0	24.9	elbow (θ), SN 6-7, transition(i), SN 7-AHU					
8	50000	9.70	56.6	1.001	810	0.20	450	1300	3.00	2.89	808	10.70	11.3	3.0	14.3	transition(i) AHU-SN8					
9	50000	9.70	56.6	1.001	810	0.25	450	1300	6.00	2.89	808	21.30	14.2	6.0	20.2	elbow (θ), SN 8-9					
10	50000	9.70	56.6	1.001	810	0.25	450	1300	12.00	2.89	808	42.60	14.2	12.0	26.2	elbow (θ), SN 9-10					
11	25000	8.20	40.5	1.000	623	0.45	350	1000	12.00	2.86	626	32.90	18.2	12.0	30.2	wye main(m), transition(θ), SN10-11					
12	25000	8.20	40.5	1.000	623	0.25	350	1000	6.00	2.86	626	16.40	10.1	6.0	16.1	elbow (θ), SN 11-12a					
13	20000	7.80	36.6	1.011	571	0.45	350	800	6.00	2.29	567	14.00	16.5	6.1	22.5	wye main(n), transition(θ), SN12a-13a					
14	15000	7.30	32.1	1.021	511	0.45	300	800	6.00	2.67	520	13.40	14.4	6.1	20.6	wye main(r), transition(θ), SN13a-14a					
15	10000	6.60	26.2	1.018	439	0.45	300	550	6.00	1.83	439	10.40	11.8	6.1	17.9	wye main(θ), transition(θ), SN14a-15a					
16	5000	5.50	18.2	0.992	340	0.45	300	550	6.00	1.83	439	10.40	8.2	6.0	14.1	wye main(v), transition(w), SN15a-16a					
17	2500	3.74	8.4	1.003	292	0.50	275	270	3.00	0.98	298	3.30	4.2	3.0	7.2	dove tail(x), rectangular round(y), SN 16a-17a					
18																flexible duct(ε =2.0, D=300), SN17a-diffuser					
19																					
20																					
21																					
											Total:	340.3	224.4	116.5	340.9						

Table 3: Calculate Fan Total (Static) Pressure Required (Ptr)

$$P_t = F1 + F2 + F3 + F4 + F5 + F6 + F7 + F8 + F9 + F10$$

$$341 + 15 + + 30 + + 220 + + 15 + + 23 = 644 \text{ Pa}$$

- F1: pressure loss, from Table 2
- F2: outlet diffuser(10-25Pa)
- F3: silencer box(150-500Pa)
- F4: volume damper(VD,1.5-30Pa)
- F5: inlet / outlet hood with screen(80-200Pa)
- F6: AHU internal pressure loss(120-250Pa)
- F7: Fan unit internal loss(SEF,70-250Pa)
- F8: other 1 : return grille(10-20Pa)
- F9: other 2 : Fine Damper(FD,20-40Pa)
- F10: other 3 :Exas VDX(15-30Pa)

*ASHRAE recommended values & Maker's data are preferred.

Table 4: Calculate Fan Motor Power Required (kW)

$$kW = \frac{Q * PT \text{ (or PS)}}{1000} = \frac{340.3 * 1.90}{1000} = 6.66 \text{ kW (8.88 HP)}$$

Ranges of θ f, θ m & θ b : **Maker's data are preferred.**

Q (L/s)	≤ 1,000	≤ 3,000	≤ 6,000	≤ 12,000	≤ 18,000	≥ 20,000
θ f	0.42-0.5	0.45-0.55	0.5-0.6	0.55-0.7	0.6-0.75	0.7-0.8
θ m	0.70-0.85		0.75-0.90		0.87-0.95	
θ b			0.75-1.0	(=1.0 if no belt is used)		

θ f : fan total pres. eff, or static pres. eff. θ m if static pres. is used

θ m : motor eff, θ b : belt eff, P T : total pres., P S : static pres

FS=PT - Pv @ fan outlet

588=645-57

F class Motor(E3), SFI.15

motor power kW(HP) 3220V 60Hz

phase / volt / Hz 3220V 60Hz

fan type backwrd.

Table 5: Specify Fan's Specifications

Fan Job	5000	645	588	0.55 (0.5)	0.88	1.0	7.5 (10)	3220V 60Hz	backwrd.	remarks
flow rate Q (L/s)										
total pres. PT (Pa)										
static pres. PS (Pa)										
fan eff. θ f (θ s)										
motor eff. θ m										
belt eff. θ b										

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