

※本軟體包含一光碟片(CD)及一執行鎖(key)，打開 eDUCT 資料夾後，點選 SETUP，並依指示步驟，完成安裝程序，然後在電腦桌面上，會出現 eDUCT 執行檔畫面。(2020/04/15)

## **eDUCT** 風管軟體使用手冊(中譯本)

- ★供計算風管之直管及配件的全壓/靜壓損失，等速度法及等摩擦損失均適用。
- ★供計算風管尺寸(圓管/矩管)，鍍鋅風管表面積(m<sup>2</sup>)、風機馬力(kW/HP)。
- ★供驗算 Moody chart、Darcy equation 及 Colebrook equation(學術研究用)。

### (A)符號說明：

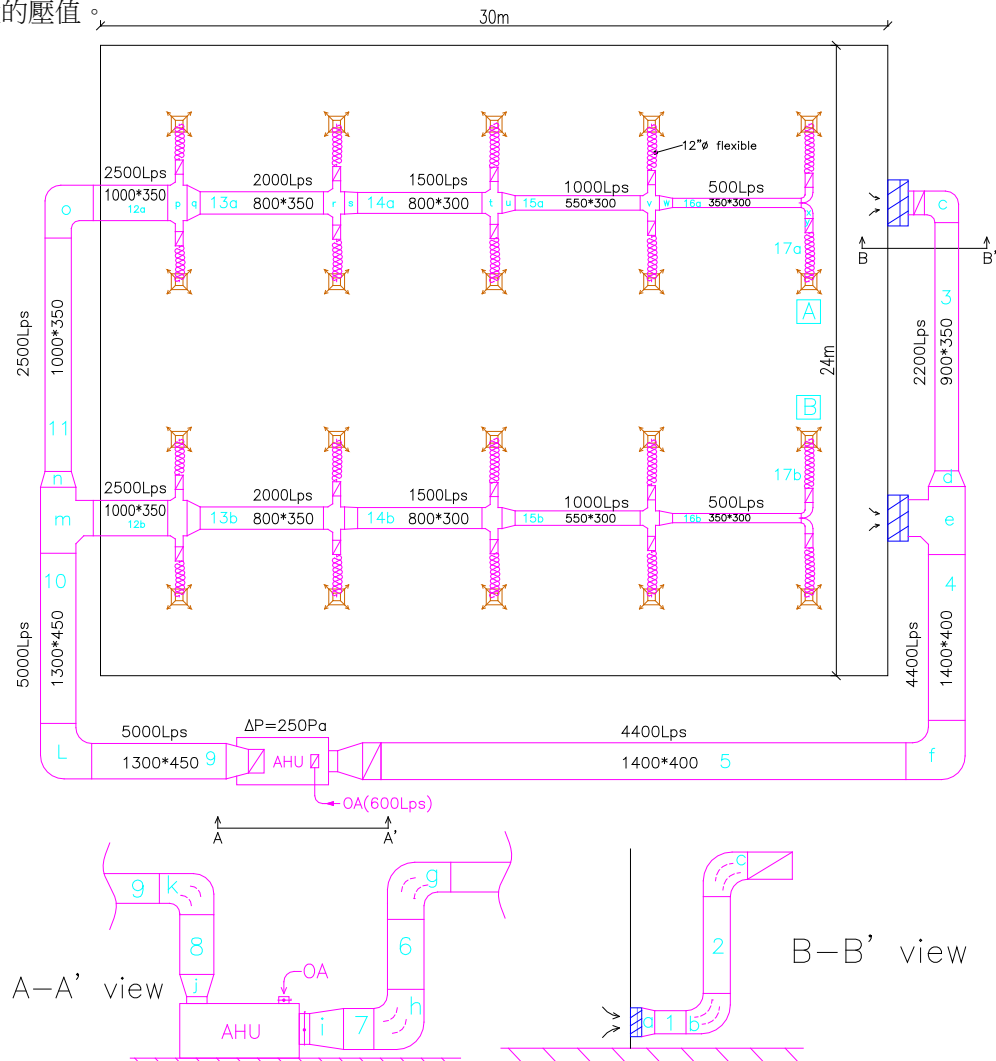
FN : fitting No.	v : kinematic viscosity(m <sup>2</sup> /s)	P <sub>f</sub> : fitting pressure loss(Pa,=C <sub>s</sub> *P <sub>v</sub> )
SN : serial No.	ε/D: relative roughness (-)	P <sub>m</sub> : main duct pressure loss(Pa,=ΔP <sub>L</sub> *L)
Q : flowrate(L/s)	Re : Reynolds No.(-)	P <sub>t</sub> : total pressure loss(Pa,=P <sub>f</sub> +P <sub>m</sub> )
V : velocity(m/s)	f : friction factor(-)	P <sub>T</sub> : fan total pres.(Pa)
ε : absolute roughness(mm)	C <sub>s</sub> : fitting loss coefficient(-)	P <sub>S</sub> : fan static pres.(Pa)
T : temperature(°C db)	H : given duct height(mm)	θ <sub>f</sub> : fan total pres. eff.
RH : relative humidity(%RH)	W : specified duct width(mm)	θ <sub>IS</sub> : fan static pres. eff.
ρ : density (kg/m <sup>3</sup> )	L : duct length(m)	θ <sub>m</sub> : motor eff.
P <sub>v</sub> : velocity pressure(Pa)	R <sub>as</sub> : aspect ratio(W/H≤5)	θ <sub>b</sub> : belt eff.
ΔP <sub>L</sub> : friction loss(Pa/m)	A <sub>s</sub> : duct area(m <sup>2</sup> ,=(H+W)×L×2.03)	θ <sub>b</sub> =1.0 if no belt is used.
D : duct diameter(mm)	De : equivalent diameter of rectangular duct(mm)	

### (B)常用之使用參數：

- (1)標準空氣(20°C & 0%RH 或密度 1.204 kg/m<sup>3</sup>)是預設值，供空調風管設計值，對於不同溫度及火煙密度，可自行更改預設值。
- (2)風管絕對粗度(ε,mm)：鍍鋅風管(0.09)；鍍鋅螺旋風管(0.12)；鋁箔軟管直管(2.0)；硬質 PVC 風管(0.04)。
- (3)其他氣體之密度(ρ)及絕對粗度(ε)可上網搜尋。

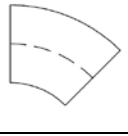
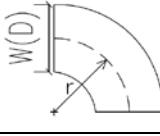
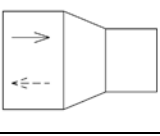
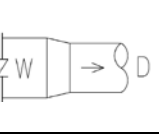
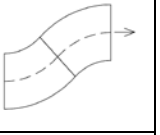
### (C)風管計算圖例：(※參考 fig2，Existing file)

- (1)將各段直風管編號，如①②③...；將彎管、分歧管等配件編號，如 a b c ...。
- (2)通常，最長路徑(※如圖 path A)之壓損值最大，但是，有時候，較短的路徑 B，可能因彎管或分歧管較多而有較大的壓值。

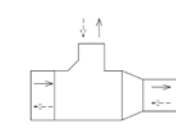
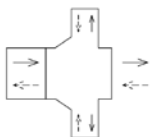
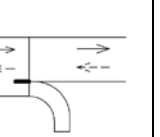
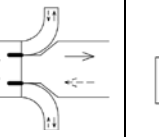
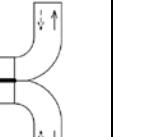


(D)常用的配件損失(Cs)概略值：

★Cs 值宜取 ASHRAE Duct Fitting Database 中的詳細值。

	1	2	3	4	5
	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)

	6	7	8	9	10
	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)

※(約 0.00) Cs 值可供一般性計算用。

(E)操作步驟：(參考電腦畫面)

- (1) **fig 1**：選擇 **New Project (新案)** 或 **Existing file(查舊檔案)**
- (2) **fig 2**：選擇一既有檔案，如 **fig 2** 中之 **eDUCT Software**，並點選 **OK**。
- (3) **fig 3**：
  - ① 在 **Customer**、**Project** 及 **Date** 欄中，填入自訂(中)文字。
  - ② 在 **Must Inputs** 欄中，填入風量(Q)Lps、風速(V)m/s、ε (mm)及溫度(°C)，預設值：ε (0.09)，T(20°C)，RH(0.1%，不得填 0.0%)。
  - ③ 在 **Option Input** 欄中：填入必要時改變更預設的 0.1%RH 及 1.204 值。
  - ④ 在 **Remarks** 欄中：填入直管編號及配件編號等說明。
  - ⑤ 勾選 **NEXT(次頁)**或 **EXIT(退出)**。

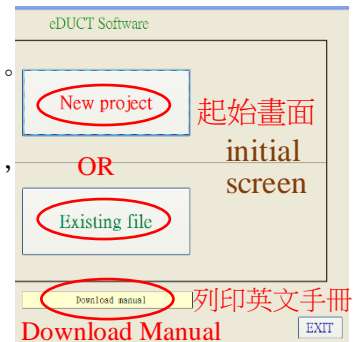


fig1.

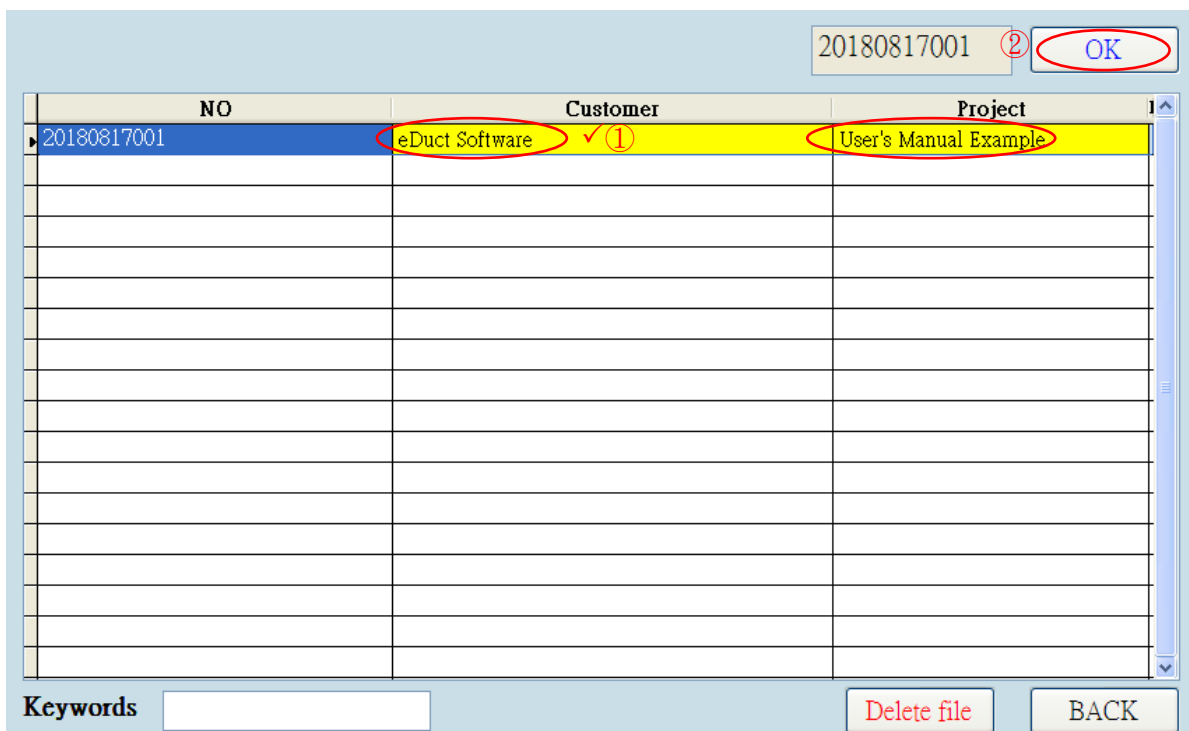


fig 2.

⑥若採用「等摩擦損失法」，如 **fig 3** 中第 8 欄，假設等摩擦損失值  $\Delta PL$  為 1.00Pa/m，則需在 V(m/s)欄中(第 2 欄)，數次填入不同風速值(m/s)，直到  $\Delta PL$ (第 8 欄) $\div$ 1.00Pa/m 為止。

⑦第 11~13 欄之數值，供學術研究驗證 **Corebrook 公式**( $1/\sqrt{f}=2\log[0.27(\epsilon/D)+(2.51/Re/\sqrt{f})]$ )。

(4) **fig4**：輸入 Cs, H(風管高 mm), W(風管寬 mm)及 L(該段風管長度 m)，快點 2 下 Cs 欄，即會顯示預設值(0.2, 350, 700 及 1.00)，此預設值可更改；若採用圓型風管，H 欄填入風管直徑(mm)。在 W 欄，數次填入風管寬度(mm)(※錯誤嘗試法)，例如，在 SN1(第一列)之 W 欄中，填入 800(mm)，再看 De 欄之數值是否等於 D 欄之數值，如果不相同，再變更 W 欄之數值，例如，900(mm)，直到 De 欄(597) $\div$ D 欄(592)為止。※H(風管高度)是設計者應自行決定。As 欄(m<sup>2</sup>)是指該段風管所需的風管鐵皮面積(m<sup>2</sup>)，供估價用，As(m<sup>2</sup>)=(H+W)\*L\*2.03，3%是製作風管的鐵皮損失率。

※如果欲變更 **fig4** 畫面的任何在"Copied from Table 1"的數值，或是在 Remarks 欄之文字，則需點選 **BACK**，回到上個畫面(**fig 3**)中更改。

fig 3.

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

SN	Must Inputs ②			Option Input ③					Outputs					④ Remarks
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Q L/s	V m/s	$\epsilon$ mm	T °C	RH %	$\rho$ kg/m <sup>3</sup>	Pv Pa	$\Delta PL$ Pa/m	D mm	$v$ m <sup>2</sup> /s	$\epsilon/D$	Re	f	Noted by Designer FN & SN refer to attached duct diagram
1	2200.0	8.00	0.090	20.0	0.1	1.204	38.5	1.016	592	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	0.0001508	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	
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	$\Delta PL$ Pa/m	D mm	Cs	H mm	W mm	L m	Ras W/H	De mm	As m <sup>2</sup>	Pf Pa	Pm Pa	Pt Pa	Noted by Designer FN & SN refer to attached duct diagram
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	2.86	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	
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

★for deleting all inputs

→ Copied to fig 5 automatically

(5) **fig5**：完成在 **Table 3~Table 5** 中之必要輸入後，點選 **SAVE** 後，即可點選 **PRINT1** 或 **PRINT2**，來列印 **Table1** 或 **Table2**。

- ①計算所得的  $P_{tr}=644\text{Pa}$  是全壓損失(※並非靜壓損失)，若要計算靜壓( $P_s$ )，計算公式為  $P_s = P_{tr} - P_v$  @風機出口風速=645-57=588Pa (※Table 2)，見 p6/6 之 SN8，@Q=5000Lps 及  $V=9.7\text{ms}$ ， $P_v=56.6\text{Pa}$  及 Table3， $P_{tr}=644\text{Pa}$ 。
- ②填入風車全壓(PT)，建議： $P_{tr} \leq PT \leq 1.05P_{tr}$ 。
- ③必要時可填入風車靜壓(PS)，建議： $P_{sr} \leq PS \leq 1.05P_{sr}$ 。
- ④參考廠商資料，填入全壓效率( $\theta_f$ )，或靜壓效率( $\theta_{fs}$ )。
- ⑤填寫相關資料，空調風機可採用 **F** 級馬達，若為消防排煙風機，宜採用 **H** 級馬達。
- ⑥列印前先點選 **SAVE**。

fig 5

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

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

$P_{tr} = 341 + 15 + 0 + 30 + 0 + 220 + 0 + 15 + 0 + 23 = 644$  ①

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 YD(15-30Pa) → can be changed.

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

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**Table 4: Calculate Fan Motor Power Required(kW)**

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

$5000 * 645 / (1 * 1000000 * 0.55 * 0.88 * 1.00) = 6.66 \text{ kW ( } 8.88 \text{ HP)}$  ②

defaults:  $0.7 * 0.8 * 0.9$

Ranges of  $\theta_f$ ,  $\theta_m$  &  $\theta_b$  \*Maker's data are preferred.

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

$\theta_f$ : fan total pres. eff., or static pres. eff.  $\theta_{fs}$  if static pres. is used.  
 $\theta_m$ : motor eff.,  $\theta_b$ : belt eff.,  $P_T$ : total pres.,  $P_S$ : static pres.,  $P_S = P_T - P_v$  @fan outlet

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**Table 5: Specify Fan's Specifications**

Fan Job	flow rate Q (L/s)	total pres. PT (Pa)	static pres. PS (Pa)	fan eff. $\theta_f$ ( $\theta_{fs}$ )	motor eff. $\theta_m$	belt eff. $\theta_b$	motor power kW(HP)	phase / volt / Hz	fan type	remarks
	5000 ⑤	645 ②	-- ③	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

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**Table 1 : Duct Basic Analysis Data (eDUCT)**

Customer: eDuct Software

Project: User's Manual Example, HY AC system

Date: 2020/04/06

SN	Must Inputs			Option Input			Outputs				Remarks			
	Q L/s	V m/s	ε mm	T °C	RH %	ρ kg/m <sup>3</sup>	Pv Pa	ΔPL Pa/m	D mm	ν m <sup>2</sup> /s		ε/D	Re	f
1	22000	8.00	0.090	20.0	0.1	1.204	38.5	1.016	592	0.00001508	0.000152	313988.2	0.0156	Noted by Designer FN & SN refer to attached duct diagram
2	22000	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(4)
3	22000	8.00	0.090	20.0	0.1	1.204	38.5	1.016	592	0.00001508	0.000152	313988.2	0.0156	elbow (4), SN 1-2
4	44000	9.40	0.090	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	elbow(4), SN 2-3
5	44000	9.40	0.090	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
6	44000	9.40	0.090	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	elbow(4), SN 4-5
7	44000	9.40	0.090	20.0	0.1	1.204	53.2	0.999	772	0.00001508	0.000117	481334.7	0.0145	elbow(4), SN 5-6
8	50000	9.70	0.090	20.0	0.1	1.204	56.6	1.001	810	0.00001508	0.000111	521228.1	0.0143	elbow(4), SN 6-7, transition(4), SN 7-AHU
9	50000	9.70	0.090	20.0	0.1	1.204	56.6	1.001	810	0.00001508	0.000111	521228.1	0.0143	transition(4), AHU-SN8
10	50000	9.70	0.090	20.0	0.1	1.204	56.6	1.001	810	0.00001508	0.000111	521228.1	0.0143	elbow(4), SN 8-9
11	25000	8.20	0.090	20.0	0.1	1.204	40.5	1.000	623	0.00001508	0.000144	338870.6	0.0154	elbow(4), SN 9-10
12	25000	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(4), transition(4), SN 10-11
13	20000	7.80	0.090	20.0	0.1	1.204	36.6	1.011	571	0.00001508	0.000158	295610.1	0.0158	elbow(4), SN 11-12a
14	15000	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(4), transition(4), SN 12a-13a
15	10000	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(4), transition(4), SN 13a-14a
16	5000	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(4), transition(4), SN 14a-15a
17	2500	3.74	2.000	20.0	0.1	1.204	8.4	1.003	292	0.00001508	0.006856	72370.7	0.0347	wye main(4), transition(4), SN 15a-16a
18														dovetail(x), rectangular-rod(y), SN 16a-17a
19														flexible duct(ε=2.0, D=200), SN 17a-diffuser
20														
21														

Note 1: Standard air (20°C & 0%RH or 1.204 kg/m<sup>3</sup>) 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 aluminum, 100% extruded(0.20)

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)  
 ρ : density (kg/m<sup>3</sup>) Pv : velocity pressure (Pa) ΔPL : friction loss (Pa/m) f : friction factor (ε) D : diameter (mm) ν : kinematic viscosity (m<sup>2</sup>/s)  
 ε/D : relative roughness (ε) Re : Reynolds No. (ε) Reas : aspect ratio (WH ≤ 5) De : equivalent diameter of rectangular duct Δs : dust surface area (m<sup>2</sup> = (H+W)\*L\*#2.03)  
 W : specified duct width (mm) L : duct length (m) Pn : main duct pressure loss (Pa = ΔPL \* L) θfs : fan static pres. eff. θb : belt eff. Q : specified flow rate (L/s)  
 Pft : fitting pressure loss (Pa = Cs \* V) Pts : fan total pres. eff. P : fan total pressure (Pa) PT : fan total pressure (Pa) CS : section fitting loss coefficient (ε) H : known duct height (mm)  
 PS : fan static pres. (Pa) θfs : fan static pres. eff. θb : belt eff. P : fan total pressure (Pa) PT : fan total pressure (Pa) CS : section fitting loss coefficient (ε) H : known duct height (mm)  
 Δs : dust surface area (m<sup>2</sup> = (H+W)\*L\*#2.03)

PRINT 2

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

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	A <sub>s</sub> m <sup>2</sup>	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	Noted by Designer FN & SN refer to attached duct dia gram
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	return grille-1 transition(θ)
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), SN1-2
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	elbow (θ), SN2-3
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	transition(θ), wye main(θ), SN3-4
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), SN4-5
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), SN5-6
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	elbow (θ), SN6-7, transition(θ), SN7-AHU
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	transition(θ) AHU-SN8
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), SN8-9
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	elbow (θ), SN9-10
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	wye main(m), transition(n), SN10-11
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	elbow (θ), SN11-12a
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(p), transition(q), SN12a-13a
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(r), transition(s), SN13a-14a
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(t), transition(u), SN14a-15a
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	wye main(v), transition(w), SN15a-16a
18																dove tail(x), rectangular-round(y), SN 16a-17a
19																flexiable duct(ε =2.0, D=300), SN17a-diffuser
20																
21																
Total:												340.3	224.4	116.5	340.9	

Table 3: Calculate Fan Total (Static) Pressure Required (P<sub>tr</sub>)

P<sub>tr</sub> = F1 + F2 + F3 + F4 + F5 + F6 + F7 + F8 + F9 + F10 + 20 + 15 + 30 + 20 + 23 = 644 Pa

- F1: pressure loss, from Table 2
- F2: outlet diffuser(10-25Pa)
- F3: silencer box(150-500Pa)
- F4: volume damper(W D, 15-30Pa)
- 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 : Fan Damper(FD, 20-40Pa)
- F10: other 3 : Extra VDO(15-30Pa)

\*A SHRA E recommened values & Maker's data are preferred.

Table 4: Calculate Fan Motor Power Required (kW<sub>r</sub>)

kW<sub>r</sub> =  $\frac{1 * 10^{-6} * \theta f * \theta m * \theta b}{Q * PT \text{ (or PS)}}$  =  $\frac{1 * 10^{-6} * 0.55 * 1.0}{5000 * 645}$  = 6.66 kW (8.88 HP)

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

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

θ f : fan total pres. eff., or static pres. eff. θ f is if static pres. is used  
 θ m : motor eff, θ b : belt eff, P T : total pres., P S : static pres.

PS=PT - Pv @fan outlet  
 588=645-57

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 f)	motor eff. θ m	belt eff. θ b	motor power kW (HP)	phase / volt / Hz	fan type	remarks
	5000	645	588	0.55 (0.5)	0.88	1.0	7.5 (10)	3/220V, 60Hz	backward	F class Motor(IE3), SFI.15

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