MODUL -5

EXHAUST SYSTEM DESIGN

DESIGN PROCEDUE

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7.1. PENGANTAR

Pertimbangan Desain sangat tergantung pada bentuk dan lay out peores operasi, ruang kerja dan bentuk kontruksi bangunan

Banyak faktor yang berperan dalam menetukan bentuk desain ventilasi.

Dan sebelum mengambil keputusan yang diambil dalam proses desain perlu dibuat ; (1) sketsa sistim saluran pipa/duct guna mengidentifikasi kontaminan dan (2) menentukan ukuran .

7.2. DESIGN PROCEDURE

Materi pokok meliputi :

EXHAUST SYSTEM, HOOD , & FAAN ;

1. Design exhaust hood, dan matari kuliah bagian ke-4,
2. Chapter 3, buku Industrial ventilasi 20 th edition, American Conference Of Govermental Industrial Hygienists, 1988
3. Duct size Tabel 5.5 Halaman 5-41, buku Industrial ventilasi 20 th edition, American Conference Of Govermental Industrial Hygienists, 1988.
4. Buat sketsa ruang yang akan didesain atau kebtuhan dari industri

7.3. PRINSIP DESAIN

1). Q = V.A

dimana ;

Q = volumemetrik flow rate, cfm --- atau aliran udara di cfm (kaki kubik per menit)

V = Anerage velocity, fpm ---atau kecepatan linier di kaki per menit

A = Cross-sectional area, ft^2,--- atau luas penampang (duct, hood, dll) sistem di kaki persegi

2). Duct Area

$$A = D^2 \frac{\pi}{4}$$

Atau bisa menggunakan tabel 5-5, area and circumfrence of circles

3.) Duct Velocity Pressure

$$V = 1096 \sqrt{\frac{VP}{P}}$$

atau,

$$--- VP = P \left(\frac{V}{1096} \right)^2$$

$$V = 4005 . \sqrt{VP}$$

atau,

$$---VP = \left(\frac{V}{4005} \right)^2$$

dimana :

V = kecepatan,/velocity, fpm

VP = kecepatan tekanan /velocity pressure, “wg

SLOTS

4). SLOTS VILOCITY PRESSURE

$$VPs = (Vs/4005)^2$$

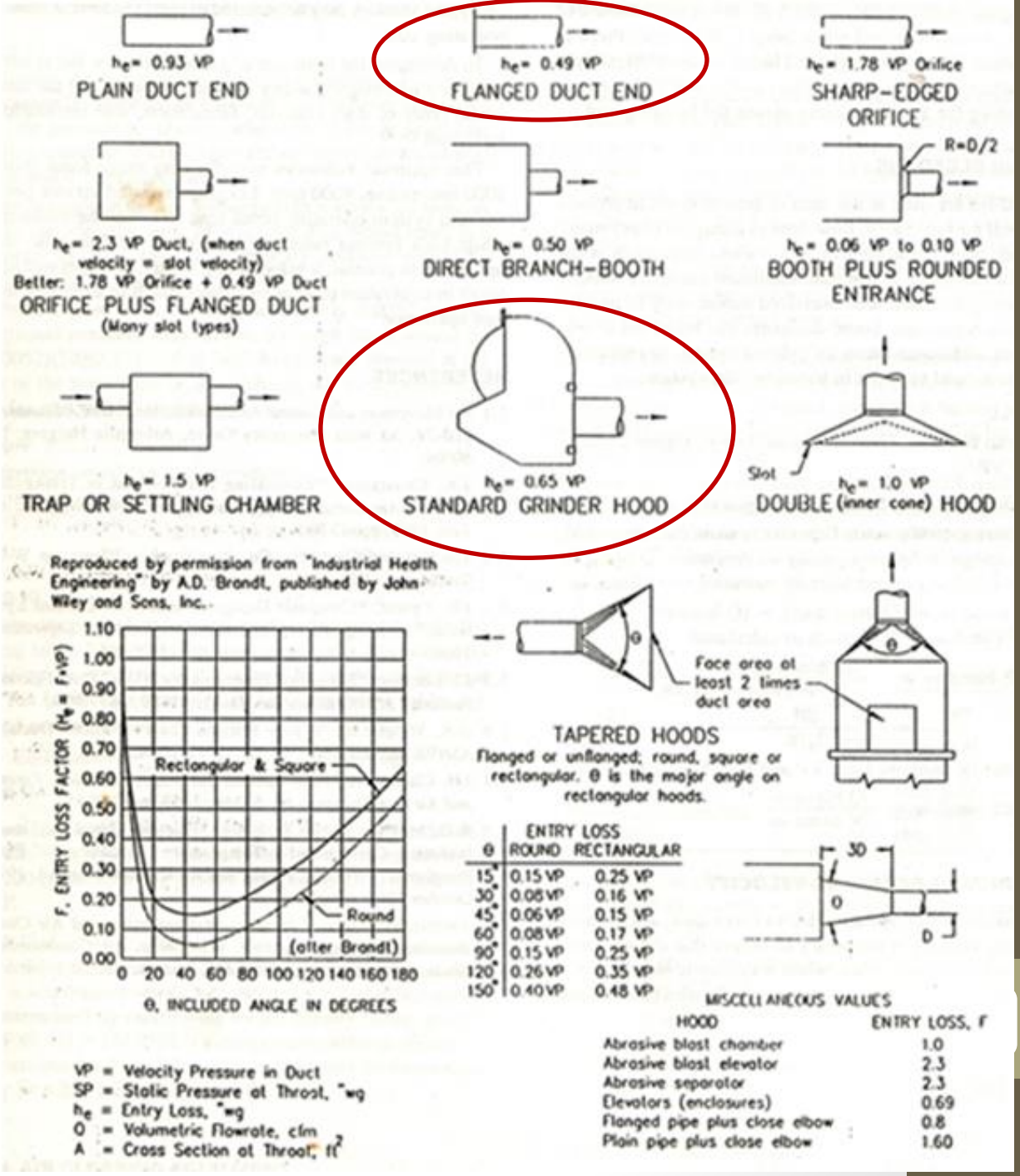
5). SLOTS LOSSES PRESSURE

SLOTS LOSSES FACTOR + ACCELETAIAN FACTOR

7). SLOTS FACTOR

8). SLOTS STATIC PERSSURE

SP = VPs * VP



HOOD

9). DUCT ENTRY LOSS FACTOR, fig.5-15, Cap.-10

10). DUCT ENTRY LOSS PRESURE/VP

= DUCTRI LOSS FACTOR + ACCELERATION

11). DUCR ENTRY LOSS

= VP x DUCT ENTRI LOSS PRES

12). Takanan Statik/Hood Static Pressure (SP)

Sloots Static Press + Duct Entry Loss + Other Losses

7.4. DESIGN METHODS

7.4.1. VELOCITY PRESURE METHODE

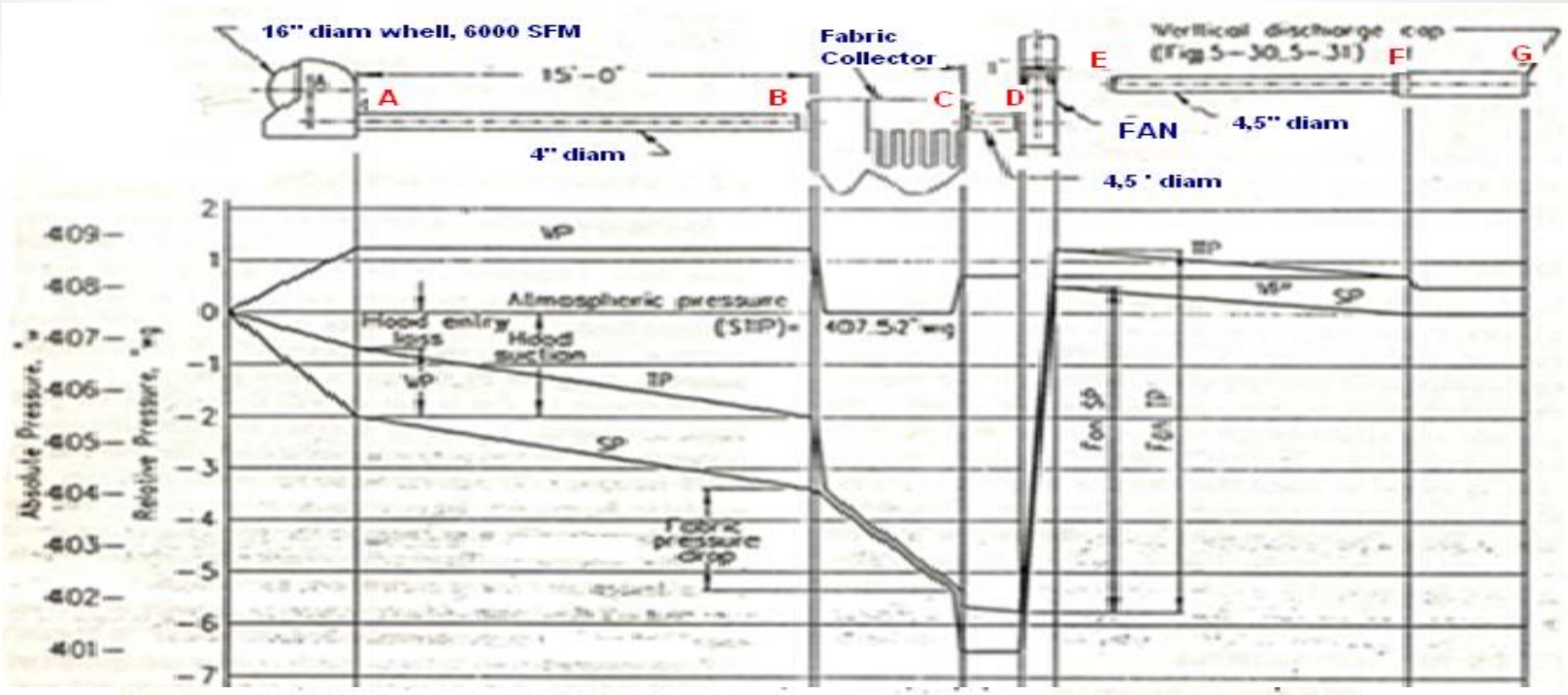
Plant Name : ---------- Evaluation :----------Data: -------
Location : ---------- Temperature;----------Drawing No;----------
Departement ; ---------- Factor ; ----------Designer; ----------

1.	Duct Segment Indentifications				Satuan		
2.	Volumetric Flowrate --- $Q=V*A$				cfm		
3.	Minimum Transport Velocity				fpm		
4.	Duct Diameter				inches		
5.	Duct Area --- $A=1/4\pi*(D)^2$				sq.ft		
6.	Actual Duct Velocity---$V=Q/A$ item 2 : 5				fpm		
7.	Duct Velocity Pressure -- $VP=(V/4005)^2$				"wg		
8.	HOOD SUCTIONS	SLOTS	Slot Area		sq.ft		
9.			Slot Velocity		fpm		
10.			Slot Velocity Pressure---$VPs=(Vs/4005)^2$		"wg		
11.			Slot Loss Factor fig.5-15 or Chap.10				
12.			Acceleration Factor		0 or 1		
13.			Plenum loss per VP , item 11 + 12				
14.			Plenum SP , item 10 * 13		"wg		
15.		Duct Entry Loss Factor fig.5-15 or Chap.10					
16.		Acceleration Factor			0 or 1		
17.		Duct Entry Loss per VP, item 15 + 16					
18.		Duct Entry Loss, item 7 * 17					
19.		Other Loss			"wg		
20.		Hood Static Pressure, item 14 + 18 + 19			"wg		
21.	Straight Duct Length				feet		
22.	Friction Factor (H_f) fig.5-18 or quation						
23.	Friction Los per VP, item 21*22						
24.	No.of 90^0 Elbow						
25.	Elbow Loss per VP, item 24 x loss Factor						
26.	No. Entries						
27.	Entry Loss per VP, item 26 x loss Factor						
28.	Special Fitting Loss Factor						
29.	Duct Loss per VP, item 23 + 25 + 27 + 28						
30.	Duct Loss, item 7 * 29				"wg		
31.	Duct SP Loss, item 20 + 30				"wg		
32.	Comulatif Static Pressure				"wg		
33.	Governing Static Pressure				"wg		
34.	Corrected Volumetric Flowrate				cfm		
35.	Resultant Velocity Pressure				"wg		

CONTOH

Problem 1, figure 5-1, Aliran udara dihitung sebagai produk dari luas penampang sistem dan kecepatan udara.

$$Q = AV, \quad \text{----} \quad TP = SP + VP$$



Details of Operation

NO.		HOOD NO.	VS–PRINT	REQUIRED AIR FLOW, cfm
1	16" Diameter Grinding wheel, 2" Wide	A	411	390

Dimensions

No. of Branch or Main	Straight Run, Ft	CFM Required	Elbows	Entries
ab	15	390	--	--
bc	Collector	390	--	--
cd	1	390	--	--
ef	10	390	--	--
fg	Stack Head	390	--	--

figure 5-1

Velocity Pressure Method Calculation Sheet

Plant Name: PROBLEM-1 Elevation: Date: _____
Location: _____ Temp: Drawing #.: _____
Department: _____ Factor: Designer: _____

				Satuan	A-b	b-c	c-d	e-f
1.	Duct Segment Indentifications							
2.	Volumetric Flowrate --- $Q=V*A$			cfm	390	390	390	390
3.	Minimum Transport Velocity			fpm	4500			
4.	Duct Diameter			inches	4	-	4.5	4.5
5.	Duct Area --- $A = 1/4\pi*(D)^2$			sq.ft	0.0873		0.1104	0.1104
6.	Actual Duct Velocity—$V=Q/A$ item 2 : 5			fpm	4467		3531	3531
7.	Duct Velocity Pressure -- $VP = (V/4005)^2$			"wg	1.24		0.78	0.78
8.	HOOD SUCTIONS	SLOTS	Slot Area	sq.ft				
9.			Slot Velocity	fpm				
10.			Slot Velocity Pressure—$VPs = (Vs/4005)^2$	"wg				
11.			Slot Loss Factor fig.5-15 or Chap.10					
12.			Acceleration Factor	0 or 1				
13.			Plenum loss per VP , item 11 + 12					
14.			Plenum SP , item 10 * 13	"wg				
15.		Duct Entry Loss Factor fig.5-15 or Chap.10			0.65		0.49	
16.		Acceleration Factor		0 or 1	1		1	
17.		Duct Entry Loss per VP, item 15 + 16			1.65		1.49	
18.		Duct Entry Loss, item 7 x 17			2.05		1.16	
19.		Other Loss		"wg		2.00		
20.		Hood Static Pressure, item 14 + 18 + 19		"wg	2.05		1.16	
21.	Straight Duct Length			feet	15		1	10
22.	Friction Factor (H_f) fig.5-18 or quation				0.0703		0.062	0.062
23.	Friction Los per VP, item 21x22				1.05		0.062	0.62
24.	No.of 90^0 Elbow							
25.	Elbow Loss per VP, item 24 x loss Factor							
26.	No. Entries							
27.	Entry Loss per VP, item 26 x loss Factor							
28.	Special Fitting Loss Factor							
29.	Duct Loss per VP, item 23 + 25 + 27 + 28				1.05		0.062	0.62
30.	Duct Loss, item 7 x 29			"wg	1.30		0.05	0.48
31.	Duct SP Loss, item 20 + 30			"wg	3.35	2.0	1.21	
32.	Comulatif Static Pressure			"wg	-3.35	-5.35	-6.56	0.48
33.	Governing Static Pressure			"wg				
34.	Corrected Volumetric Flowrate			cfm				
35.	Resultant Velocity Pressure			"wg				

Terima Kasih