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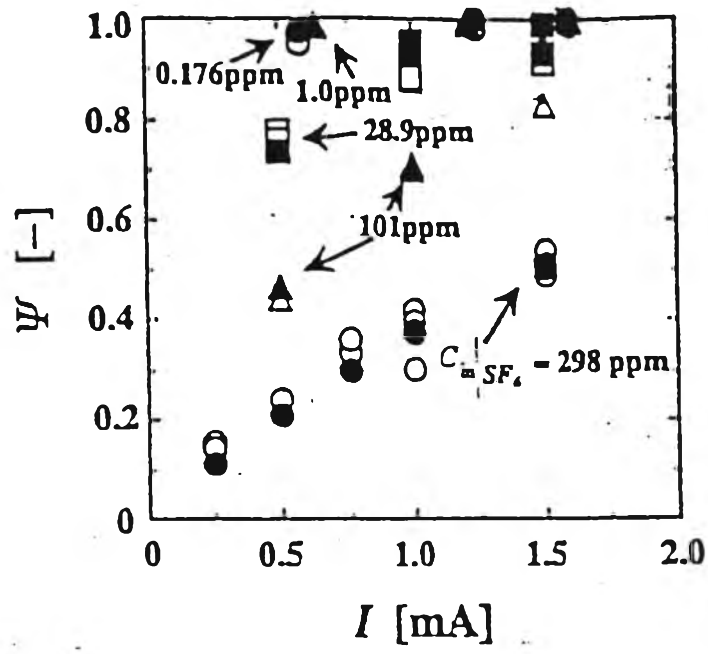
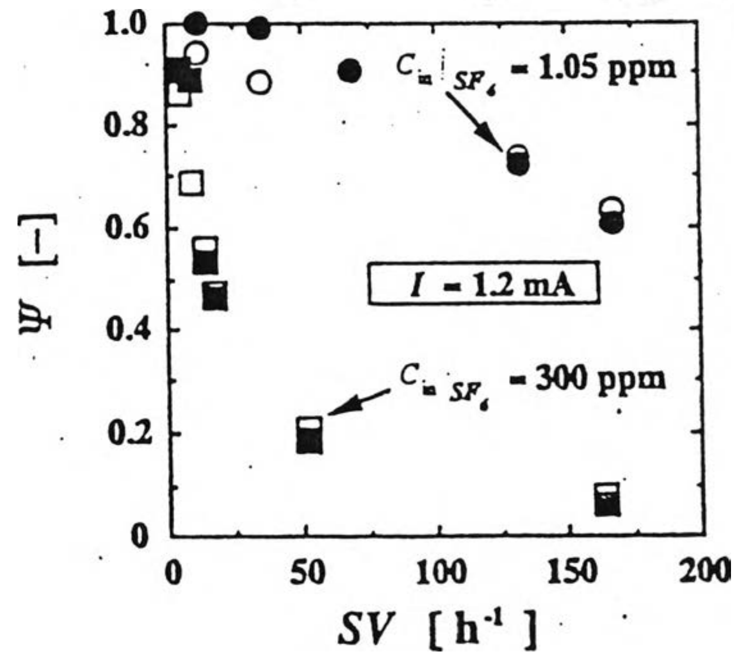
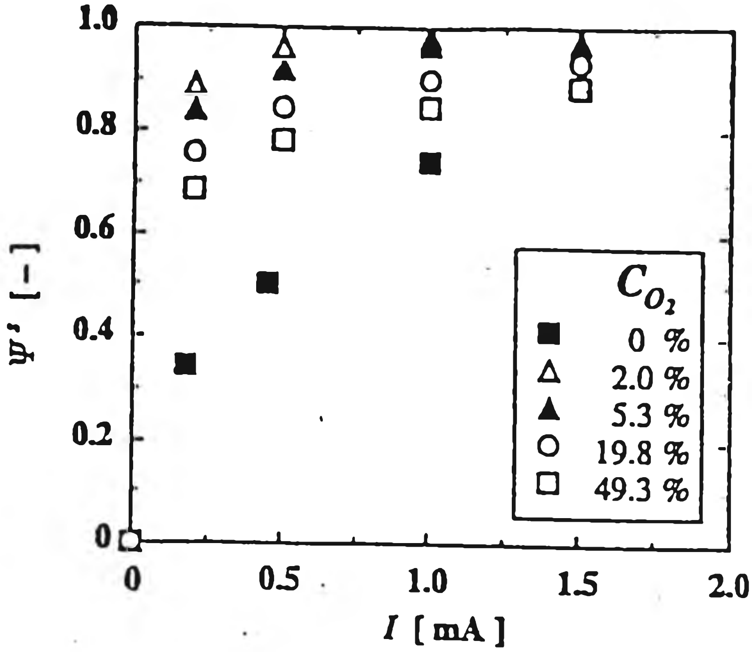
ภาคผนวก ก ข้อมูลการทดลองประสิทธิภาพการกำจัดก๊าซมลพิษด้วย Electron Attachment



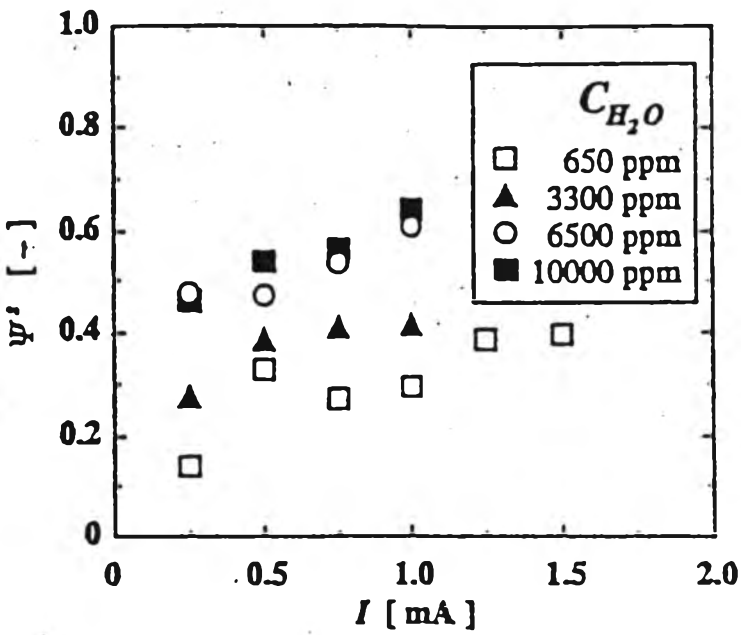
รูปที่ ก.1 ประสิทธิภาพการกำจัด SF_6 ที่กระแสค่าต่างๆ (7)



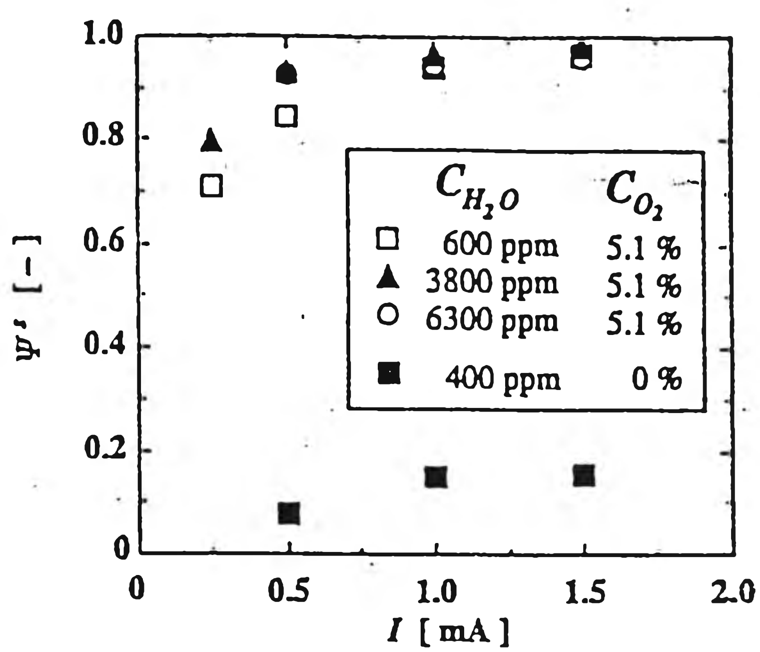
รูปที่ ก.2 ประสิทธิภาพการกำจัด SF_6 ที่ Space Velocity ค่าต่างๆ (7)



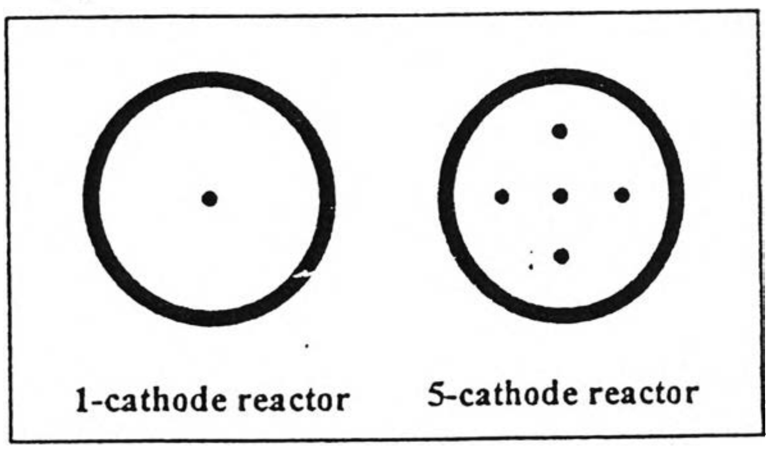
รูปที่ ก.3 ประสิทธิภาพการกำจัด CS_2 ในกระแสก๊าซที่มี O_2 อยู่ร่วม (7)



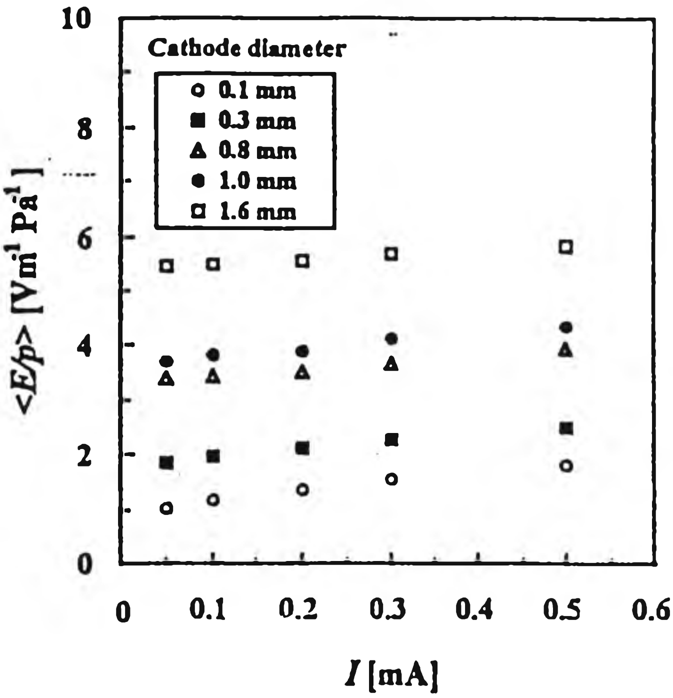
รูปที่ ก.4 ประสิทธิภาพการกำจัด COS ในกระแสก๊าซที่มี H_2O อยู่ร่วม (7)



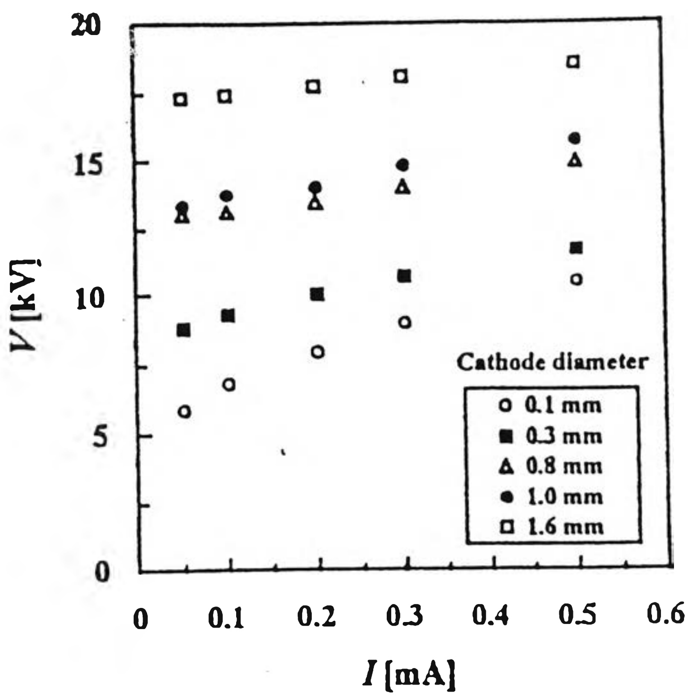
รูปที่ ก.5 ประสิทธิภาพการกำจัด SO_2 ในกระแสก๊าซที่มี O_2 และ H_2O อยู่ร่วม (7)



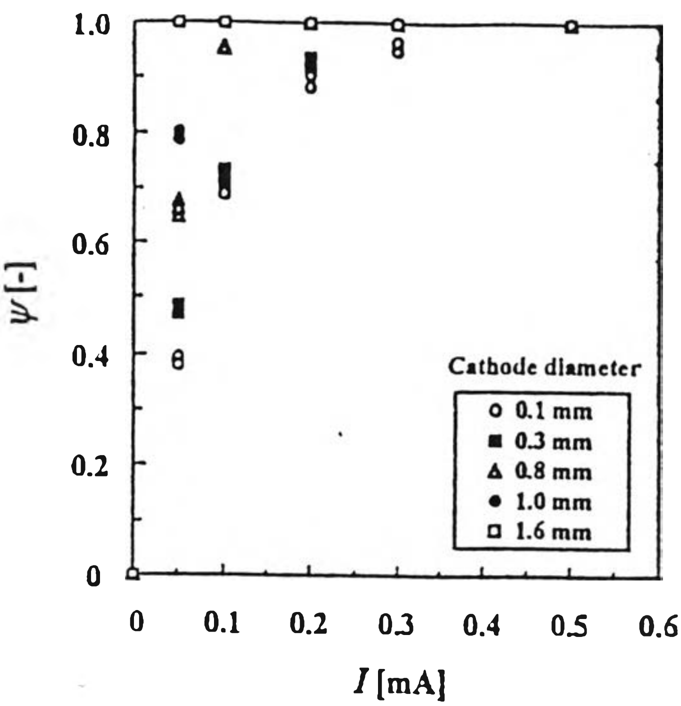
รูปที่ ก.6 ภาคตัดขวางของเครื่องปฏิกรณ์ชนิดคาโธดเดี่ยวและคาโธด 5 เส้น (7)



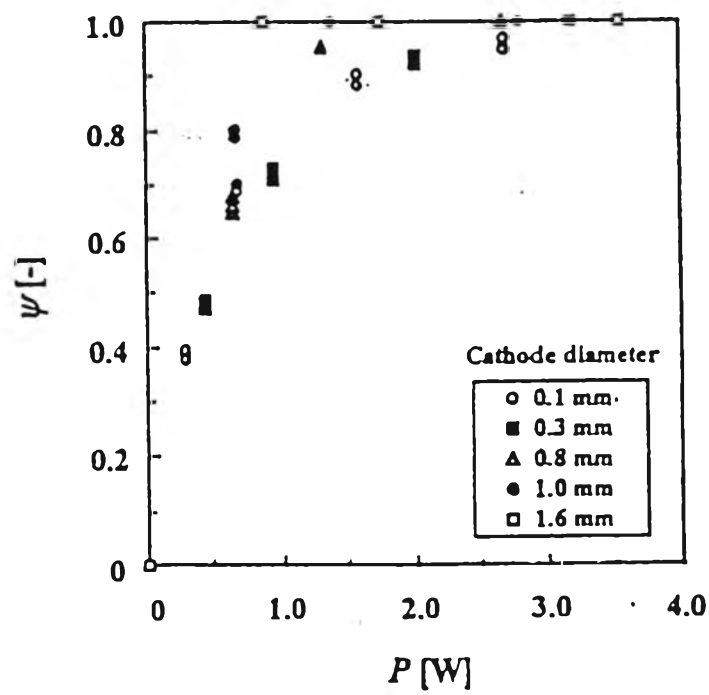
รูปที่ ก.7 ความสัมพันธ์ระหว่างกระแสและแรงดันไฟฟ้าในการกำจัด CH_3I (7)



รูปที่ ก.8 ความสัมพันธ์ระหว่าง E/P กับกระแสไฟฟ้าในการกำจัด CH_3I (7)



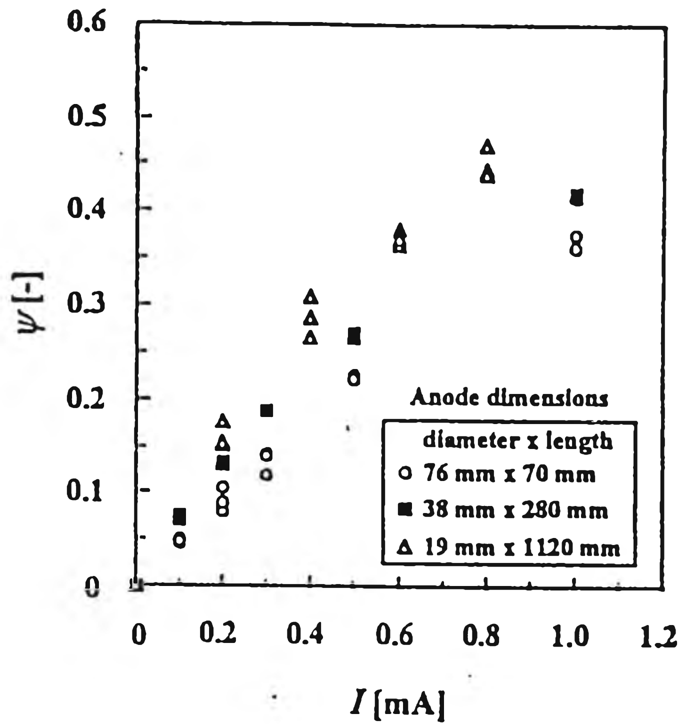
รูปที่ ก.9 ประสิทธิภาพการกำจัด CH_3I ที่กระแสไฟฟ้าและคาโธดขนาดต่างๆ (7)



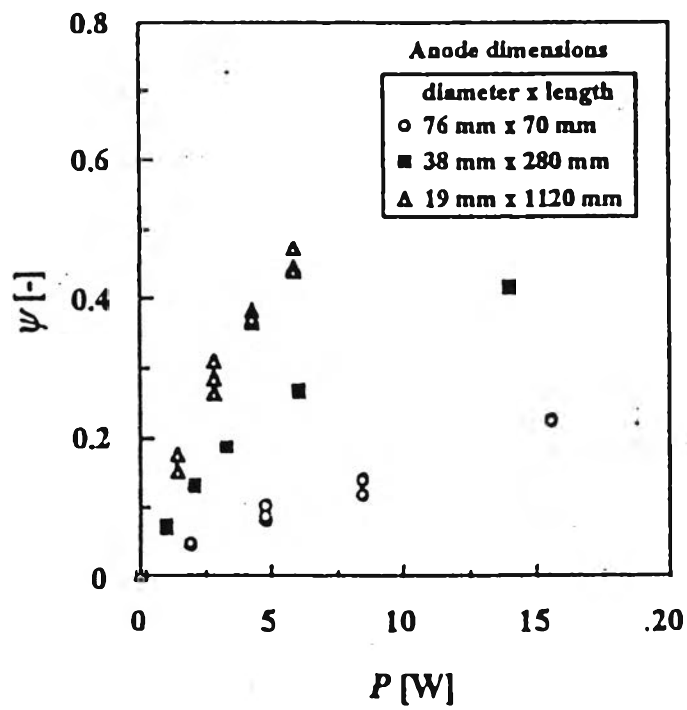
รูปที่ ก.10 ประสิทธิภาพการกำจัด CH_3I ที่กำลังไฟฟ้าและคาโธดขนาดต่างๆ (7)

รูปที่ ก.11 ประสิทธิภาพการกำจัด CH_3I ที่กำลังไฟฟ้าและคาโธดขนาดต่างๆ (7)

รูปที่ ก.12 ประสิทธิภาพการกำจัด CH_3CHO จากอากาศและจาก N_2 ที่กำลังไฟฟ้าต่างๆ (7)

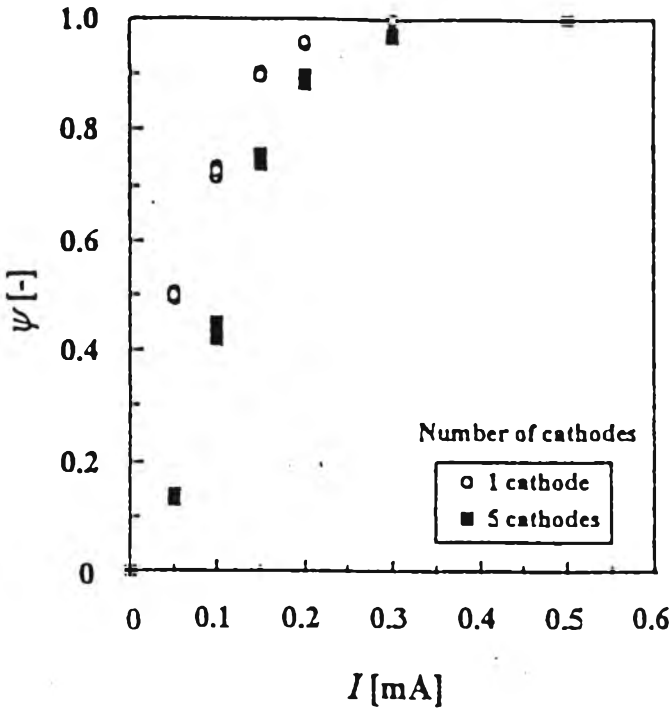


รูปที่ ก.13 ประสิทธิภาพการกำจัด $C_2Cl_3F_3$ ที่กระแสไฟฟ้าและคาโธดรูปร่างต่างๆ (7)

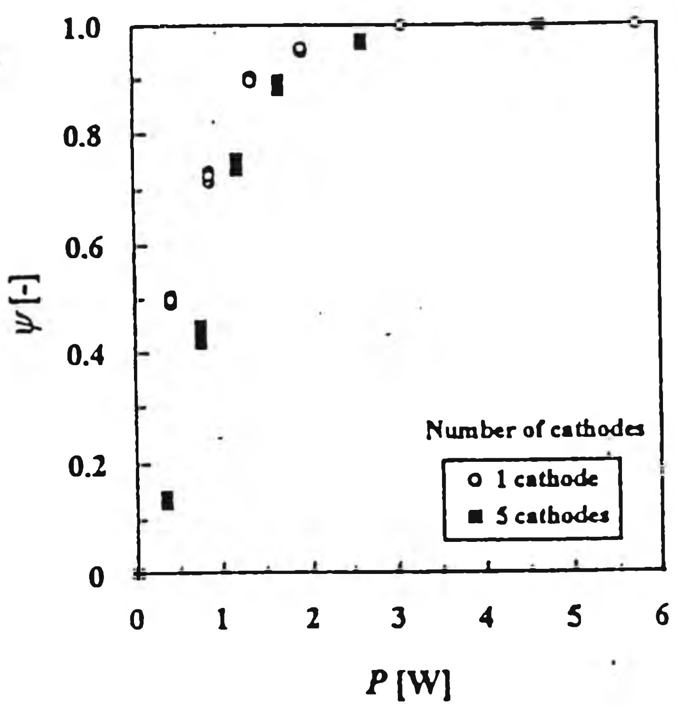


รูปที่ ก.14 ประสิทธิภาพการกำจัด $C_2Cl_3F_3$ ที่กำลังไฟฟ้าและคาโธดรูปร่างต่างๆ (7)

ต้นฉบับ หน้าขาดหาย



รูปที่ ก.17 ประสิทธิภาพการกำจัด CH_3CHO ที่กระแสไฟฟ้าต่างๆ ด้วยคาโธด 1 เส้นและ 5เส้น (7)



รูปที่ ก.18 ประสิทธิภาพการกำจัด CH_3CHO ที่กำลังไฟฟ้าต่างๆ ด้วยคาโธด 1 เส้นและ 5เส้น (7)

ตาราง ก.1 อิทธิพลของความเข้มข้นของก๊าซต่อประสิทธิภาพการกำจัด (7)

Sample Gas	Experimental Conditions					Removal Efficiency		
	I (mA)	Sv (h^{-1})	C_{in} (ppm)	C_{O2} (%)	C_{H2O} (ppm)	Change of ψ		ψ_{Max}
						I	C_{in}	
SF_6	0.25 ~ 1.6	18.9	0.176 ~ 298	0	0	incr.	decr.	1.0
SO_2	0.25 ~ 1.6	18.9	32.7 ~ 304	0	0	incr.	decr.	0.44
$(CH_3)_2S$	0.25 ~ 1.5	18.9	3.88 ~ 89	0	0	incr.	decr.	0.90
CH_3I	0.1 ~ 2.0	47.3	27.6 ~ 144.3	0	0	incr.	decr.	0.65
$C_2Cl_3F_3$	0.1 ~ 3.0	18.9	50 ~ 400	0	0	incr.	decr.	1.0
CH_3CHO	0.1 ~ 1.0	21.8	9.9 ~ 35.6	0	0	incr.	decr.	0.88
$(CH_3)_3N$	0.5 ~ 1.0	58.6	43	0	0	incr.	-	0.40

Note : Maximum ψ under the experimental conditions.

ตาราง ก.2 อิทธิพลของค่า SV ต่อประสิทธิภาพการกำจัด (7)

Sample Gas	Experimental Conditions					Removal Efficiency		
	I (mA)	Sv (h^{-1})	C_{in} (ppm)	C_{O2} (%)	C_{H2O} (ppm)	Change of ψ		ψ_{Max}
						I	SV	
SF_6	1.2	4.7 ~ 163	1.05	0	0	-	decr.	1.0
CH_3I	0.1 ~ 2.0	24.6 ~ 76.1	81.5	0	0	incr.	decr.	0.80
CH_3CHO	0.25 ~ 1.5	21.8 ~ 66.2	35.6	0	0	incr.	decr.	0.70

ตาราง ก.3 อิทธิพลของการมีอยู่ร่วมของ O_2 และ by product ต่อประสิทธิภาพการกำจัด (7)

Sample Gas	Experimental Conditions					Reaction By-Products	Removal Efficiency		
	I (mA) / V (KV)	Sv (h^{-1})	C_{in} (ppm)	C_{O2} (%)	C_{H2O} (ppm)		Change of ψ^S: I	Change of ψ^S: C_{O2}	ψ^S_{Max}
SO_2	0.25 ~ 1.5 (10.1 ~ 14.5)	18.9	101	0 ~ 18	0	None	incr.*	incr.*	0.95
CS_2	0.18 ~ 1.5 (9.3 ~ 14.8)	18.9	30	0 ~ 49	0	SO_2 COS	incr.	max at 2% *	0.98
COS	0.2 ~ 1.5 (9.5 ~ 14.8)	18.9	29	0 ~ 50	0	SO_2	incr.	max at 2% *	0.92
CH_3SH	0.05 ~ 1.0 (6.3 ~ 14.9)	18.9	69	0 ~ 20	0	SO_2 H_2S or COS	incr.	incr.	1.0
$(CH_3)_2S$	0.25 ~ 1.0 (6.0 ~ 10)	18.9	70	0 ~ 22	0	None	incr.	incr.	1.00
$C_2Cl_3F_3$	0.1 ~ 1.5 (9.2 ~ 15.2)	18.9	400	0 ~ 20	0	HCl or HF	incr.	decr.	0.88 **
$(CH_3)_3N$	0.05 ~ 0.15 (8.3 ~ 14.0)	69.4	25	0 ~ 20	0	CH_3CHO,C_2H_5OH, $(CH_3)_2CO$ or CH3NO_2	incr.	incr.	1.0 **

Note : * ψ^S for SO_2 increased with discharge current; ψ^S for SO2 increased with the conc. Of O_2 and ψ^S of CS_2 becomes maximum at 2% of O_2 concentration.
** Maximum ψ is calculated by eq.1

ตาราง ก.4 อิทธิพลของการมีอยู่ร่วมของไอน้ำ และ by product ต่อประสิทธิภาพการกำจัด (7)

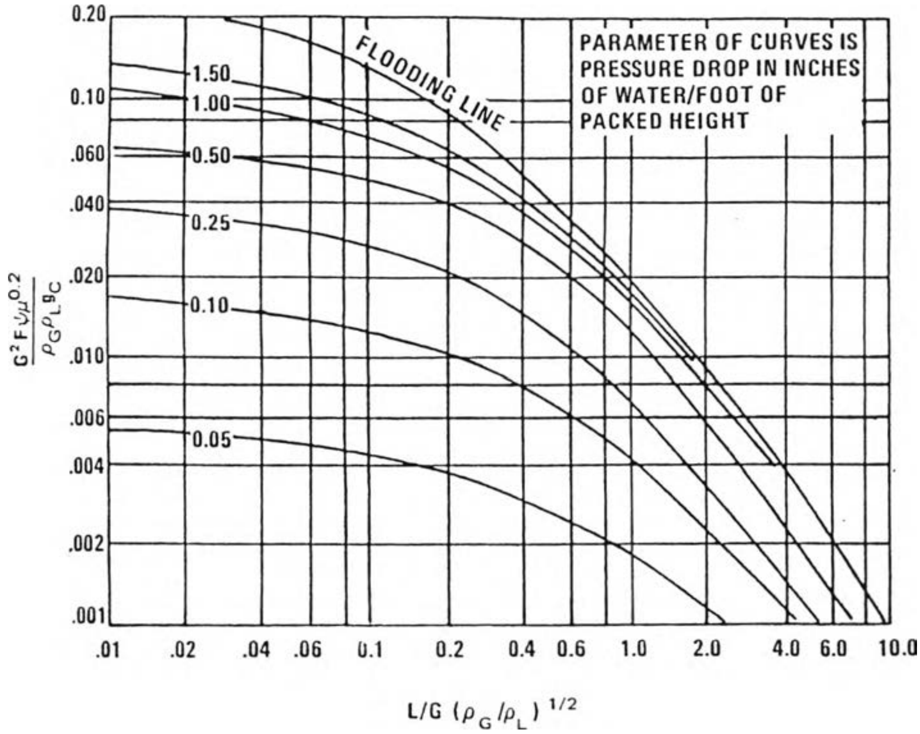
Sample Gas	Experimental Conditions					Reaction By-Products	Removal Efficiency		
	I (mA) / V (KV)	Sv (h^{-1})	C_{in} (ppm)	C_{O2} (%)	C_{H2O} (ppm)		Change of ψ^S: I	Change of ψ^S: C_{H2O}	ψ^S_{Max}
H_2S	0.2 ~ 1.45 (3.5 ~ 8.7)	37.8	60	0	400 ~ 11000	None	incr.	incr.	1.0
SO_2	0.25 ~ 1.5 (4.5 ~ 5.7)	37.8	122	0	400 ~ 13000	None	incr.	incr.	0.39
CS_2	0.25 ~ 1.4 (4.9 ~ 7.5)	37.8	48	0	300 ~ 11000	SO_2 COS	incr.	incr.	0.66
COS	0.25 ~ 1.5 (4.5 ~ 5.7)	37.8	53	0	650 ~ 10000	SO_2	incr.	incr.	0.64
CH_3SH	0.1 ~ 1.5 (4.8 ~ 6.5)	37.8	40	0	1000 ~ 10000	SO_2	Max at 0.25~0.5 mA	incr.	0.65
$(CH_3)_2S$	0.25 ~ 1.5 (4.5 ~ 5.6)	52.9	38	0	1100 ~ 9100	SO_2	Max at 0.5 mA	incr.	0.27

ตาราง ก.5 อิทธิพลของการมีอยู่ร่วมของไอน้ำและ O_2 และ by product ต่อประสิทธิภาพการกำจัด (7)

Sample Gas	Experimental Conditions					Reaction By-Products	Removal Efficiency		
	I (mA) / V (KV)	Sv (h^{-1})	C_{in} (ppm)	C_{O2} (%)	C_{H2O} (ppm)		Change of ψ^S: I	Change of ψ^S: C_{H2O}	ψ^S_{Max}
SO_2	0.25 ~ 1.5 (9.0 ~ 14.5)	37.8	120	5.0	600 ~ 6300	None	incr.	incr.*	0.89
CS_2	0.25 ~ 1.5 (8.5 ~ 14.0)	37.8	65	14.5	600 ~ 9500	SO_2 COS	incr.	decr.	0.93
$(CH_3)_2S$	0.1 ~ 1.5 (8.0 ~ 14.0)	52.9	39	7.9	600 ~ 5600	SO_2	incr.	incr.	0.98

Note : * Negligible in high discharge current.

ภาคผนวก ข. ข้อมูลการหาความดันลดแบบแพคภายในหอสัมผัสตรง (19)



Packing Factors*
(DUMPED PACKING)

Packing Type	Material	Nominal Packing Size (Inches) ¼	⅜	½	⅝	¾	1 or #1	1¼	1½	2 or #2	3	3½ or #3
Intalox®	Metal						41		25	16		13
Hy-Pak™	Metal						43		26	18		15
Super Intalox® Saddles	Ceramic						60			30		
Super Intalox Saddles	Plastic						33			21		16
Pall Rings	Plastic				97		52		40	24		16
Pall Rings	Metal				70		48		33	20		16
Intalox® Saddles	Ceramic	725	330	200		145	92		52	40	22	
Raschig Rings	Ceramic	1600	1000	580	380	255	155	125	95	65	37	
Raschig Rings	1/32" metal	700	390	300	170	155	115					
Raschig Rings	1/16" metal			410	290	220	137	110	83	57	32	

*By permission Norton Co., from data compiled in Norton Co. Laboratories, Copyright 1977.
Packing factors determined with an air-water system in 30" I.D. Tower.

ภาคผนวก ค ค่าพารามิเตอร์ในการทำนายประสิทธิภาพในการจับฝุ่น (20)

ตาราง ค.1 ค่าพารามิเตอร์ในการทำนายประสิทธิภาพในการจับฝุ่น (20)

Aerosol	Scrubber type	α	β
Raw gas (lime dust and soda fume)	Venturi and cyclonic spray	1.470	1.050
Prewashed gas (soda fume)	Venturi, pipe line and cyclonic spray	0.915	1.050
Talc dust	Venturi	2.970	0.362
	Orifice and pipe line	2.700	0.362
Black liquor recovery furnace fume	Venturi and cyclonic spray	1.750	0.620
Cold scrubbing water humid gases			
Hot fume solution for scrubbing (humid gases)	Venturi, pipe line and cyclonic spray	0.740	0.861
Hot black liquor for scrubbing (dry gases)	Venturi evaporator	0.522	0.861
Phosphoric acid mist	Venturi	1.330	0.647
Foundry cupola dust	Venturi	1.350	0.621
Open-hearth steel furnace fume	Venturi	1.260	0.569
Talc dust	Cyclone	1.160	0.655
Copper sulfate	Solivore (A) with mechanic spray generator	0.390	1.140
	(B) with hydraulic nozzles	0.562	1.060
Ferrosilicon furnace fume	Venturi and cyclonic spray	0.870	0.459
Odorous mist	Venturi	0.363	1.410

ภาคผนวก ง สรุปการคำนวณหาความสามารถในการละลายของก๊าซต่างๆ ในน้ำของระบบบำบัดแบบ Electron Attachment

ตาราง ง.1 การคำนวณหา Activity Coefficient ขององค์ประกอบก๊าซต่างๆ

at Temperature : **313.15** K

Component Name	Chemical Formula	Equation	No. of C	α	ε	ζ	log γ	γ
Acetaldehyde	CH_3CHO	a	2	-0.617	0.605	0.272	0.729	5.358
Styrene	$C_6H_5CH=CH_2$	f	8	3.554	0.622	-0.466	10.336	2.166E+10
Acetic Acid	CH_3COOH	a	2	-0.880	0.603	0.37	0.511	3.243
Propane	C_3H_8	a	3	0.688	0.642	0	2.614	411.150

Note : 1.) Reference "The Properties of Liquids and Gases",Reid,Mcgraw-Hill.
2.) Data is extrapolated from reference.

ตาราง ง.2 ค่าคงที่ของเฮนรี่ขององค์ประกอบก๊าซต่างๆ

at Temperature : **313.15** K

Component Name	Chemical Formula	Henry's Constant ($1/K_H$)	Reference
Hydrogen Sulfide	H_2S	1.30E-03	a
Carbon Dioxide	CO_2	4.20E-04	a
Ammonia	NH_3	2.8	a
Sulfer Dioxide	SO_2	2.50E-05	a

Note : 1.) Reference a is from "Fundamental Calculation of Chemical Engineering"

ตาราง ง.3 ค่าความดันไอของงองค์ประกอบก๊าซทิ้งที่อุณหภูมิ 40 C

at Temperature : **313.15** °K

Gaseous Component		Concentration		Physical Properties				Vapor Pressure			
Concentration Case	**Component Name**	**(ppm)**	**(mg/m³)**	**MW**	**T_b (K)**	**T_c (K)**	**P_c (barA)**	**h**	**$\ln P_{vpr}$**	**P_{vpr} (barA)**	**P_{vp} (barA)**
High	N_2 (Nitrogen)			28	77.4	126.2	33.9	5.56749	3.32378	27.7652	**941.24**
	O_2 (Oxygen)			32	90.2	154.6	50.4	5.47199	2.7705	15.9667	**804.72**
Low	CO_2 (Carbondioxide)			44	194.6	304.1	73.8	7.62085	0.22024	1.24638	**91.98**
	H_2O (Water)			18	373.2	647.3	221.2	7.33316	-7.8249	0.0004	**0.0884**
	NO_x	8000	15041.6	46	121.4	180	64.8	8.61431	3.66277	38.969	**2525.19**
	SO_x	580	1517.2	64	263.2	430.8	78.8	6.83715	-2.5687	0.07663	**6.0388**
	CH_3COOH (Acetic Acid)	2400	4708.7	48	391.1	592.7	57.9	7.8483	-7.0062	0.00091	**0.05247**
	Hydrocarbons (Propane)	23000	41364.5	44	231.1	369.8	42.5	6.22544	-1.1262	0.32426	**13.7811**
Very low	CH_3CHO (Acetaldehyde)	4	7.2	44	294	461	55.7	7.05392	-3.3304	0.03578	**1.9928**
	$C_6H_5CH=CH_2$ (Styrene)	1	4.3	104	418.3	647	39.9	6.71843	-7.1625	0.00078	**0.0309**
	H_2S (Hydrogen Sulfide)	1	1.4	34	213.5	373.2	89.4	5.98917	-1.1485	0.31712	**28.35**
	CH_3SH (Methyl Mercaptan)	0.1	0.2	48	279.1	470	72.3	6.23941	-3.1252	0.04393	**3.1760**
	$((CH_3)_2S)$ (Dimethyl Sulfide)	0.1	0.3	62	310.5	503	55.3	6.45132	-3.9112	0.02002	**1.1069**
	NH_3 (Ammonia)	37	25.7	17	239.8	405.5	113.5	6.82879	-2.0139	0.13347	**15.1492**
	$((CH_3)_3N)$ (Trimethyl Amine)	2.3	5.5	59	276	433.3	40.9	6.48849	-2.4895	0.08295	**3.39266**

Reference :

1.) Reid,Prausnitz,Poling, "The Properties of Gases and Liquids",Mcgraw-Hill,Chapter7,P.205-238..

2.) Based on eq. 7.2.4 and 7.2.5.

3.) The equations are

eq.7.2.4) $h = T_{br}*\ln(P_c/1.01325) / (1-T_{br})$

eq.7.2.5) $\ln P_{vpr} = h(1-1/T_r)$

$P_{vpr} = P_{vp}/P_c$

T_b = Normal Boiling Temperature,K

T_c = Critical Temperature,K

T_r = Reduced Temperature,K

P_c = Critical Pressure,barA

P_{vp} = Vapor Pressure,barA

ตาราง ง.4 ความเข้มข้นขององค์ประกอบก๊าซทิ้งซึ่งละลายในน้ำ

at Temperature : **313.15** K

Component Name	Chemical Formular	MW	Concentration in Gas (ppm)	Vapor Press of Pure Comp (BarA)	Henry's Constant ($1/K_H$)	Liquid Activity (γ_A)	Case	Liquid Fraction (X_A) (Kg_a/Kg_W)
Acetaldehyde	CH_3CHO	44	4	1.983	N/A	5.318	1	**9.207E-07**
Styrene	$C_6H_5CH=CH_2$	104	1	0.031	N/A	2.166E+10	1	**8.622E-15**
Acetic Acid	CH_3COOH	48	2400	0.052	N/A	3.243	1	**3.761E-02**
Propane	C_3H_8	44	23000	13.733	N/A	411.150	1	**9.888E-06**
Hydrogen Sulfide	H_2S	34	1	28.253	1.30E-03	N/A	2	**2.456E-09**
Carbon Dioxide	CO_2	44	20000	91.657	4.20E-04	N/A	2	**2.053E-05**
Ammonia	NH_3	17	37	15.085	2.8	N/A	2	**9.784E-05**
Sulfer Dioxide	SO_2	64	580	6.012	2.50E-05	N/A	2	**5.156E-08**
Nitrogen Oxide	NO	30	8000	2519.210	N/A	N/A	3	**5.293E-06**
Methyl Mercaptan	CH_3SH	48	0.1	3.162	N/A	N/A	3	**8.434E-08**
Dimethyl Sulfide	$((CH_3)_2S)$	62	0.1	1.101	N/A	N/A	3	**3.127E-07**
Trimethyl Amine	$((CH_3)_3N)$	59	2.3	3.378	N/A	N/A	3	**2.232E-06**

Note :
1.) Reference a is from "Fundamental Calculation of Chemical Engineering"
2,) Case1 : Liquid fraction is calculated from Correlation constant for Activity coefficient at infinite dilution from "The Properties of Gases and Liquids"

$$X_A = YP_T/\gamma_A P_A^*$$

Case2 : Liquid Fraction is calculated based on Henry's constant from "Perry's Chemical Engineeering Handbook",

$$X_A = P_A/K_H$$

Case3: No data available . Assume the fluid as ideal solution and use Raoult's Law,

$$X_A = P_A/P^*_A$$

ตาราง ง.5 ความเข้มข้นขององค์ประกอบก๊าซทิ้งในกระแสก๊าซขาออกจากหอสัมผัสตรง

Inlet Gas data :	Total Flow Rate	**1512.7**	Kg/h	**Outlet Water data :**	Total Flow Rate	**13404.7**	Kg/h
	MW_{AV}	**28.82**			Temperature	**40**	^oC
Outlet Gas data :	Total Flow Rate	**1455.4**	Kg/h	**Inlet Water data :**	Total Flow Rate	**13354**	Kg/h
	MW_{AV}	**29.51**			Temperature	**30**	^oC

at Temperature : **313.15** K

Component Name	Chemical Formula	MW	Inlet Stream: Conc. In Water ($X_{A,i}$) (Kg_A/Kg_W)	Inlet Stream: Conc. In Gas ($Y_{A,i}$) (Kg_A/Kg_G)	Inlet Stream: Conc. In Gas ($Y_{A,i}$) (ppm)	Outlet Stream: Conc. In Water ($X_{A,o}$) (Kg_A/Kg_W)	Outlet Stream: Conc. In Gas ($Y_{A,o}$) (Kg_A/Kg_G)	Outlet Stream: Conc. In Gas ($Y_{A,o}$) (ppm)
Acetaldehyde	CH_3CHO	44	0	6.107E-06	4.0	9.207E-07	-2.133E-06	-1.4
Styrene	$C_6H_5CH{=}CH_2$	104	0	3.609E-06	1.0	8.622E-15	3.751E-06	1.1
Acetic Acid	CH_3COOH	48	0	3.997E-03	2400.0	3.761E-02	-3.423E-01	-210426.7
Propane	C_3H_8	44	0	3.511E-02	23000.0	9.888E-06	3.641E-02	24416.8
Hydrogen Sulfide	H_2S	34	0	1.180E-06	1.0	2.456E-09	1.204E-06	1.0
Carbon Dioxide	CO_2	44	0	3.053E-02	20000.0	2.053E-05	3.155E-02	21158.3
Ammonia	NH_3	17	0	2.183E-05	37.0	9.784E-05	-8.785E-04	-1525.0
Sulfer Dioxide	SO_2	64	0	1.288E-03	580.0	5.156E-08	1.338E-03	617.0
Nitrogen Oxide	NO	30	0	8.328E-03	8000.0	5.293E-06	8.607E-03	8466.1
Methyl Mercaptan	CH_3SH	48	0	1.666E-07	0.1	8.434E-08	-6.037E-07	-0.4
Dimethyl Sulfide	$((CH_3)_2S)$	62	0	2.151E-07	0.1	3.127E-07	-2.657E-06	-1.3
Trimethyl Amine	$((CH_3)_3N)$	59	0	4.709E-06	2.3	2.232E-06	-1.566E-05	-7.8

Note : 1.) Reference a is from "Fundamental Calculation of Chemical Engineering"

2,) Case1 : Liquid fraction is calculated from Correlation constant for Activity coefficient at infinite dilution from "The Properties of Gases and Liquids"

$$X_A = YP_T/\gamma_A P_A$$

Case2 : Liquid Fraction is calculated based on Henry's constant from "Perry's Chemical Engineeering Handbook",

$$X_A = P_A/H_A$$

Case3: No data available . Assume the fluid as ideal solution and use Raoult's Law,

$$X_A = P_A/P^*_A$$

ภาคผนวก จ สรุปการคำนวณออกแบบหอทำความเย็นแบบสัมผัสตรง

Direct-Contact Gas Cooler Sizing

	A	B	C	D	E	F	G	H
	Gas				**Water**			
1	Mass Flow Rate	1392.67	(Kg/h.)		Mass Flow Rate		13354.33	(Kg/h.)
2	Inlet Temp.	400	(°C)		Inlet Temp		30.05	(°C)
3		673.15	(K)				303.2	(K)
4	Outlet Temp.	150	(°C)		Outlet Temp.		40.05	(°C)
5		423.15	(K)				313.2	(K)
6	C_p In Gas	1.01	(KJ/Kg°C)					
7	C_p Out Gas	1.01	(KJ/Kg°C)					
8	C_p In Vap Water	2.11	(KJ/Kg°C)					
9	C_p Out Vap Water	1.94	(KJ/Kg°C)					

ตาราง จ.1 ค่าเริ่มต้นและค่าสมมติฐานในการคำนวณ

		Basis : 1 ft²(0.0929 m²) of Ground Area						
		Assumption			**Assumption**			
10	**Basic Assumption**	Inlet Gas Load	G (Kg/h)	680.27	Water Diffusion from Inlet Gas to Water Body	%	**42.2**	**Basic Assumption**
11	**Input Data**	Inlet Humidity in Inlet Gas	X_1 (Kg/Kg)	0.08624	Outlet Humidity Content in Outlet Gas	X_2 (Kg/Kg)	**0.04985**	**From (G-10)**
12	**Input Data**	Total Water in Inlet Gas	(Kg/h)	58.67	Total Water in Outlet Gas	(Kg/h)	33.91	**From (G-10)&(C-11)**
13		Inlet Dew Point	DP_i (°C)	50.6	Outlet Dew Point	DP_o (°C)	**41.08**	**From (G-12)**
14	**Input Data**	Latent Heat of Water at Sat. Temp.	Lamda (KJ/Kg)	2380.76	Latent Heat of Water at Sat. Temp.	Lamda (KJ/Kg)	2403.9	**From (G-13)**
15	**Cal.**	Enthalpy of Inlet Gas	H_1 (KJ/Kg $_{dry\ air}$)	691.9	Enthalpy of Outlet Gas	H_2 (KJ/Kg $_{dry\ air}$)	290.4	**Cal.**
16					Total Heat Load	$H_1 - H_2$ (KJ/h)	**273110.8**	**From(C-15)&(G15)**
17					Liquid Load	L (Kg/h)	6523.1	**From (G-16)**

ตาราง จ.2 การคำนวณสภาวะของก๊าซทิ้งและน้ำภายในหอ

		Description		**Interval 1** K_xaV/L 0–0.025	**Interval 2** K_xaV/L 0.025–0.050	**Interval 3** K_xaV/L 0.050–0.075	**Interval 4** K_xaV/L 0.075–0.1	**Interval 5** K_xaV/L 0.10–0.1123	**Interval 6**
18		No. of Diffusion Unit	**K_xaV/L**	0.025	0.025	0.025	0.025	0.012	
19		Specific Heat of Inlet Gas	**c** (KJ/Kg.°C)	1.192	1.192	1.192	1.192	1.192	
20		Lewis No.	**L_e**	0.95	0.95	0.95	0.95	0.95	
21		Heat Transfer Coeff.	**h_aV** (KJ/h °C)	184.7	184.7	184.7	184.7	90.9	
		Heat Transfer Convection							
22		Convection Heat Transfer Rate	**q_c** (KJ/h)	66482.5	51895.6	40527.5	31661.1	12173.5	
23		Diff Temp of Gas	**delT** (°C)	82.0	64.0	50.0	39.0	15.0	
24		Out Temp	**$T_{interval}$** (°C)	318.0	254.0	204.1	165.0	150.0	
		Diffusion							
25	**Row-34 of previous Column**	Sat. Humidity at Inlet Water Temp	**X'** (Kg/Kg)	0.047	0.0394	0.03442	0.0306	0.02781	
26			**K_xaV** (Kg/h)/(Kg/Kg)	163.08	163.08	163.08	163.08	80.23	
27		Moiture Diffusion to Gas	**$K_xaV(X-X')$** (Kg/h)	6.40	6.10	5.45	4.77	2.01	
28		Moisture Remain	(Kg/h)	52.27	46.16	40.71	35.94	33.93	
29		Latent Heat at Sat. Temp	**Lamda** (KJ/Kg)	2406.4375	2413.8	2419.38	2424.1	2427.88	2429.33
30		Diffusion Heat Transfer Rate	**q_d** (KJ/h)	15398.88	14734.85	13193.28	11560.21	4874.39	
31		Total Heat Transfer Rate	**q_d+q_c** (KJ/h)	81881.39	66630.44	53720.83	43221.34	17047.92	
		Outlet Water Condition							
32		Diff Temp.	**del t** (°C)	3.00	2.44	1.97	1.58	0.62	
33		Out Water Temp	**$t_{interval}$** (°C)	37.05	34.61	32.65	31.06	30.44	
34		Sat. Humidity of Gas at Outlet Water Temp	**X'** (Kg/Kg)	0.0394	0.03442	0.0306	0.02781	0.02688	
35		Humidity of Outlet Gas	**X** (Kg/Kg)	0.07683	0.06786	0.05984	0.05283	0.04988	

ตาราง จ.3 สรุปการคำนวณของแต่ละช่วงภายในหอ

	Interval	K_xaV/L	T (°C)	t (°C)	Water Diffuse (Kg/h)	q_c (KJ/h)	q_d (KJ/h)	Total Heat (KJ/h)
36	1	0.025	318.0	37.05	6.40	66482.5	15398.9	81881.4
37	2	0.025	254.0	34.61	6.10	51895.6	14734.9	66630.4
38	3	0.025	204.1	32.65	5.45	40527.5	13193.3	53720.8
39	4	0.025	165.0	31.06	4.77	31661.1	11560.2	43221.3
40	5	0.012	150.0	30.44	2.01	12173.5	4874.4	17047.9
41	6				0.00	0.0	0.0	0.0
42	Summary	0.1123			24.73	202740.3	59761.61	262501.9

ตาราง จ.4 การออกแบบขนาดของหอ

n_d ($K_x aV/L$)		**0.1123**
Gas Load (Kg/h.0.0929m^2)	(G)	**680.27**
Actual Gas Load (Kg/h.)		**1392.7**
Cross section (m^2)	(S)	0.19
Liquid Load (Kg/h.0.0929m^2)	(L)	**6523.1**
Actual Liq Load (Kg/h)		13354.3
$K_x a$ (lb/h.ft^3.lb/lb)		6188.3
Fill Height (m)	(Z)	0.08
Safety Factor		6.3
Actual Fill Height (m)		0.50
Tower Diameter (m)	(D)	0.5
Design Residence Time (sec)	(t)	1
Tower Height (m)	(H)	1.50

ภาคผนวก ฉ สรุปการทำนายประสิทธิภาพการจับฝุ่นและการออกแบบขนาดของ Demister

ตาราง ฉ.1 การทำนายประสิทธิภาพการจับฝุ่น

Press drop across Tower	(in.H_2O) (mm.H_2O)	(ΔP)	**0.54** **13.77**
Contacting power base on Gas stream energy input	(hp/1000 ACFM)	(P_G)	**0.0851**
Liquid Inlet Press	(psi) (bar)	(P_L)	**29** **2**
Liquid Feed Rate	(gpm) (m^3/h)	(Q_L)	**58.8** **13.35**
Gas Flow Rate	(ft^3/min) (m^3/h)	(Q_L)	**1207.3** **2050.96**
Contacting power base on Liq stream energy input	(hp/1000 ACFM)	(P_L)	**0.8228**
Total Contacting power Energy Input	(hp/1000 ACFM)	(P_T)	**0.9080**
Alpha		(α)	**2.97**
Beta		(β)	**0.362**
No. of Transfer Unit		(N_t)	**2.8680**
Collection Efficiency	(%)	(n)	**94.32**

ตาราง ฉ.2 การออกแบบขนาดของ Demister

Demister Type	**Wire Mesh**
Style	**780**
K Factor (General used)	**0.107**
Liquid Density (Kg/m^3)	**992.0**
Gas Density (Kg/m^3)	**0.902**
Design Velocity (m/s)	**3.55**
Area Required (m^2)	**0.136**
Dia of Demister (mm)	**0.42**
Selected Dia (mm)	**0.5**
Pressure Drop (mmAq)	**5.0**

ภาคผนวก ช สรุปการคำนวณออกแบบแพคเบคของหอสัมผัสตรงของระบบ Electron Attachment

ตาราง ช.1 การคำนวณหาความดันจากแพคเบคภายในหอสัมผัสตรง

Pressure Drop across Packing		**$\Delta P = \alpha (10\beta^L).(G^2/\rho_G)$**	
Type of Packing			1" Raschig,SS
Packing Characteristic			
Alpha	(α)		0.97
Beta	(β)		0.25
Gas Load	(G)	(Kg/h.0.0929m^2)	680.27
		(lb/ft^2.s)	0.417
Liquid Load	(L)	(Kg/h.0.0929m^2)	6523.1
		(lb/ft^2.s)	3.995
Gas Density	(ρ_G)	(Kg/m^3)	0.505
		(lb/ft^3)	0.032
Liquid Density	(ρ_L)	(Kg/m^3)	995
		(lb/ft^3)	62.117
Pressure Drop /	(ΔP)	(mmH$_2$O/m)	17.499
Packing Height		(inH$_2$O/ft)	0.210
Actual Pressure Drop		**(mmH$_2$O)**	**8.77**
		(inH$_2$O)	**0.35**

ตาราง ช.2 การตรวจสอบ Flooding Point ของแพคเบค

Domain		**$= (L/G).(\rho G/\rho L)^{1/2}$**	
Liquid Load	(L)	(Kg/h.0.0929m^2)	6523.1
		(lb/ft^2.s)	3.995
Gas Load	(G)	(Kg/h.0.0929m^2)	680.27
		(lb/ft^2.s)	0.417
Liquid Density	(ρ_L)	(Kg/m^3)	995
		(lb/ft^3)	62.117
Gas Density	(ρ_G)	(Kg/m^3)	0.505
		(lb/ft^3)	0.032
Domain			**0.216**
Abcissa		**$=G^2.F.\psi^2.\mu^{0.2}/(\rho G.\rho L.g_c)$**	
Liquid den/Water den	(ψ)		1
Liquid Viscosity	(μ)	(cP)	0.8
Packing Factor	(F)	(a/ε^3)	115
Abcissa			**0.303**
Result	**From Fig. 3.3.1, Process condition is not exceed Flooding point .**		

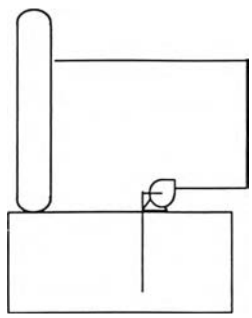
ภาคผนวก ซ การคำนวณหาขนาดของปั๊มปีของระบบ Electron Attachment

PIPING PRESSURE DROP AND PUMP DESIGN CALCULATION SHEET					
	0	24.Mar'99.	N.A.		
	Rev.	Date	Made	Chkd	Remarks

Work No.	Project Name	Item No.	No. of Required	Service
	Gas Treatment	P-101	1 + 0	Water Pump

1) FLOW

D-101 Liq. Level
Max. EL 0
Min. EL -1,000



Pump Nozzle Elev.
Suc. EL -1,000
Dis. EL 1,500

Fitting in Suction Line

Fitting			
Ord. Entrance			
Borda Entranc			
90° Elbow (S)			
90° Elbow (L)			
45° Elbow			
Tee Side Outle			
Straight Tee			
Gate Valve			
3/4 Contractio			

2) OPERATING CONDITIONS

1. Fluid Name		Water
2. Temp. Min./Nor./Max.	(°C)	/ 30 / 40
3. Sp.Gr. Min./Nor./Max.	(-)	0.992 / 0.995 /
4. Vis. Min./Nor./Max.	(cP)	0.66 / 0.9 /
5. Vap. Press. Max.	(Kg/cm²A)	0.042
6. Capa. Nor/Des/Overdes.	(m³/hr)	13.3 / 16 / 20.3%

3) SUCTION CONDITIONS

0. Destination		PUMP
Flow Rate	(m³/hr)	16
Temperature	(°C)	30
Sp.Gr.	(-)	0.995
Viscosity	(cP)	0.9
1. Line Size		
Nominal Pipe Size	(inches)	
Thickness	(-)	
Pipe Inside Dia.	(mm)	
Pipe Roughness	(mm)	0.0457
2. Velocity	(m/s)	
3. Actual Pipe Length	(m)	
4. Total Equiv. Length	(m)	
5. Fri. Loss	(Kg/cm²/100m)	
6. Min. Drum Press.	(Kg/cm²G)	0
7. Min. Liq. Static Head	(m)	0.00
	(Kg/cm²)	0.000
8. Line Loss	(Kg/cm²)	
9. Strainer Loss	(Kg/cm²)	0
10. Other Loss	(Kg/cm²)	
11. Min. Suc. Press.	(Kg/cm²G)	0.000

5) DIFFERENTIAL PRESSURE

1. Rated Dis. Press.	(Kg/cm²G)	2.569
2. Rated Suc. Press.	(Kg/cm²G)	0
3. *incl.* Special Margin	(Kg/cm²)	0.000
4. Differential Press.	(Kg/cm²)	2.569
5. Head *1	(m)	25.9

6) NET POSITIVE SUCTION HEAD

1. Min. Suc. Press.	(Kg/cm²G)	0.000
2. Vap. Press.	(Kg/cm²G)	-0.991
3. Net	(Kg/cm²)	0.991
4. Sp.Gr.	(-)	0.995
NPSH Available *2	(m)	9.9
NPSH Required *2	(m)	

4) DISCHARGE CONDITIONS

0. Destination		C-101
Elevation	(EL)	1,500
Flow Rate	(m³/hr)	16
Temperature	(°C)	30
Sp.Gr.	(-)	0.995
Viscosity	(cP)	0.9
1. Line Size		ANSI
Nominal Pipe Size	(inches)	1.1/2"
Thickness	(-)	SCH40
Pipe Inside Dia.	(mm)	40.94
Pipe Roughness	(mm)	0.0457
2. Velocity	(m/s)	3.4
3. Actual Pipe Length	(m)	1.5
4. Total Equiv. Length	(m)	2.25
5. Friction Loss	(Kg/cm²/100m)	3.083
6. Press. Loss (Kg/cm²) a. Line		0.069
b. Orifice		2
c. Exchangers		
d. Heaters		
e. Miscellaneous		0.5
Sub-total(a~e)		2.569
7. Control Valve Loss	(Kg/cm²)	
8. Max. Desti. Press.	(Kg/cm²G)	0
9. Elevation Loss	(m)	0.00
	(Kg/cm²)	0.000
10. Req'd Dis. Press.	(Kg/cm²G)	2.569

7) BRAKE HORSEPOWER

BHP = (16 m³/hr (Des.) x 0.995 (Sp.Gr.)*3 x 25.9 m) / (367.1 x 0.500 (Pump Effi-Frac.))

= 2.2 kW

8) MAX. SHUT OFF PRESSURE (As guide only)

1. Suction Drum Pressure	(Kg/cm²G)	0
2. Max. Liquid Static Head	(m)	1.00
Sp.Gr. for Max. Suc. Static Head	(-)	0.995
Max. Liquid Static Head	(Kg/cm²)	0.10
3. Max. Suction Pressure	(Kg/cm²G)	0.10
4. Max. Shut-off Pressure		

= Max Suc 0.10 + 1.2 x Diff. Press 2.58 *3 x 1.05

= 3.35 Kg/cm²G

Notes; *1 To be checked by controlling case (Min. Sp.Gr.)
*2 To be checked by controlling case (Max. Vap. Press.)
*3 To be checked by controlling case (Max. Sp.Gr.)

ภาคผนวก ฌ สรุปการคำนวณความดันสูญเสียของระบบ Electron Attachment เพื่อกำหนดขนาดของพัดลม

ตาราง ฌ.1 สรุปการคำนวณความดันสูญเสียของระบบ Electron Attachment

Stream	Fitting		Type of Fitting	Flow Rate (m^3/h)	Duct Size Equiv. (mm)	Velocity (m/s)	Velocity Press (Pa)	Length (m)	Fitting loss coefficient C_o	Duct Press drop /m (Pa)	Total Press drop (Pa)	Sectional drop (Pa)	Overall Press drop	
	No.	Source											(Pa)	(mmAq)
1,2	1	-	Duct	2957.6	304.8	11.26	32.02	13.5	-	2.370	31.994	203.303	1968.8	200.7
	2	6.6,6.2	Tee Tr	2957.6	-	11.26	32.02	-	0.55	-	17.611			
	3	7.4	Gate	2957.6	-	11.26	32.02	-	4.8	-	153.6979			
-	C-101			-	-	-	-	-	-	-	490	490		
4,5	1	-	Duct	1741.8	304.8	6.63	19.84	4.5	-	1.468	6.607	109.557		
	2	3.5	Elbow	1741.8	-	6.63	19.84	-	0.13	-	2.579			
	3	3.5	Elbow	1741.8	-	6.63	19.84	-	0.13	-	2.579			
	4	3.5	Elbow	1741.8	-	6.63	19.84	-	0.13	-	2.579			
	5	7.4	Gate	1741.8	-	6.63	19.84	-	4.8	-	95.214			
-	R-101			-	-	-	-	-	-	-	490.5	490.5		
6	1	-	Duct	1741.8	304.8	6.63	19.84	5	-	1.468	7.341	615.677		
	2	3.5	Elbow	1741.8	-	6.63	19.84	-	0.13	-	2.579			
	3	3.5	Elbow	1741.8	-	6.63	19.84	-	0.13	-	2.579			
	4	3.5	Elbow	1741.8	-	6.63	19.84	-	0.13	-	2.579			
	5	4.2	Diffuser	1741.8	-	6.63	19.84	-	0.7	-	13.885			
	6	-	Duct	6708	406.4	14.36	107.74	1	-	5.981	5.981			
	7	6.6,6.2	Tee Tr	6708	-	14.36	107.74	-	0.59	-	63.568			
	8	7.4	Gate	6708	-	14.36	107.74	-	4.8	-	517.165			
8	1	-	Duct	6708	406.4	14.36	107.74	10	-	5.981	59.807	59.807		

ตาราง ฌ.2 การคำนวณความดันสูญเสียของสายการไหลที่ 1 ของระบบ Electron Attachment

			REV.	DATE
Project	Emission Gas Treatment (Electron Attachment System)		0	Mar.25'99
LINE	Stream 1	MADE		

STATIC REGAIN DUCT SIZING

DENSITY 0.505 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.0348898 cP = 3.49E-05 N.s/m^2

	PREVIOUS	THIS	
WIDTH		380	mm
HIGH		190	mm
DIAMETER	12"	304.8	mm
		0.3048	m
AREA		0.072966	m^2
FLOW		2957.6	m^3/hr
VELOCITY		11.25945	m/s
REYNOLDS		49673.53	
LENGTH		10	m
DROP/m@THIS SECTION		2.369903	Pa/m
TOTAL DROP		23.69903	Pa
		2.42	mmAq
STATIC PRESSURE REGAIN		-24.00805	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741878
2	0.016684	7.741878	6.561000
3	0.023231	6.561000	6.665965
4	0.022505	6.665965	6.656104
5	0.022571	6.656104	6.657026
6	0.022565	6.657026	6.656940
7	0.022566	6.656940	6.656948
8	0.022566	6.656948	6.656947
9	0.022566	6.656947	6.656947
10	**0.022566**	6.656947	6.656947

USE DUCT **380** x **190** mm

ตาราง ฌ.3 การคำนวณความดันสูญเสียของสายการไหลที่ 2 ของระบบ Electron Attachment

		REV.	DATE
Project	Emission Gas Treatment (Electron Attachment System)	0	Mar.25'99
LINE	Stream 2 MADE		

STATIC REGAIN DUCT SIZING

DENSITY 0.505 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.0348898 cP = 3.49E-05 N.s/m^2

	PREVIOUS	THIS	
WIDTH		380	mm
HIGH		190	mm
DIAMETER	12"	304.8	mm
		0.3048	m
AREA		0.072966	m^2
FLOW		2957.6	m^3/hr
VELOCITY		11.25945	m/s
REYNOLDS		49673.53	
LENGTH		3.5	m
DROP/m@THIS SECTION		2.369903	Pa/m
TOTAL DROP		8.294659	Pa
		0.85	mmAq
STATIC PRESSURE REGAIN		-24.00805	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741878
2	0.016684	7.741878	6.561000
3	0.023231	6.561000	6.665965
4	0.022505	6.665965	6.656104
5	0.022571	6.656104	6.657026
6	0.022565	6.657026	6.656940
7	0.022566	6.656940	6.656948
8	0.022566	6.656948	6.656947
9	0.022566	6.656947	6.656947
10	**0.022566**	6.656947	6.656947

USE DUCT 380 x 190 mm

ตาราง ฌ.4 การคำนวณความดันสูญเสียของสายการไหลที่ 4 ของระบบ Electron Attachment

		REV.	DATE
Project	Emission Gas Treatment (Electron Attachment System)	0	Mar.25'99
LINE	Stream 4 MADE		

STATIC REGAIN DUCT SIZING

DENSITY 0.902 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.019 cP = 0.000019 $N.s/m^2$

	PREVIOUS	THIS	
WIDTH		380	mm
HIGH		190	mm
DIAMETER	12"	304.8	mm
		0.3048	m
AREA		0.072966	m^2
FLOW		1741.8	m^3/hr
VELOCITY		6.630953	m/s
REYNOLDS		95949.76	
LENGTH		3.5	m
DROP/m@THIS SECTION		1.468126	Pa/m
TOTAL DROP		5.138441	Pa
		0.52	mmAq
STATIC PRESSURE REGAIN		-14.8727	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741878
2	0.016684	7.741878	6.561000
3	0.023231	6.561000	6.665965
4	0.022505	6.665965	6.656104
5	0.022571	6.656104	6.657026
6	0.022565	6.657026	6.656940
7	0.022566	6.656940	6.656948
8	0.022566	6.656948	6.656947
9	0.022566	6.656947	6.656947
10	**0.022566**	6.656947	6.656947

USE DUCT 380 x 190 mm

ตาราง ฌ.5 การคำนวณความดันสูญเสียของสายการไหลที่ 5 ของระบบ Electron Attachment

			REV.	DATE
Project	Emission Gas Treatment (Electron Attachment System)		0	Mar.25'99
LINE	Stream 5	MADE		

STATIC REGAIN DUCT SIZING

DENSITY 0.902 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.019 cP = 0.000019 N.s/m^2

	PREVIOUS	THIS	
WIDTH		380	mm
HIGH		190	mm
DIAMETER	12"	304.8	mm
		0.3048	m
AREA		0.072966	m^2
FLOW		1741.8	m^3/hr
VELOCITY		6.630953	m/s
REYNOLDS		95949.76	
LENGTH		1	m
DROP/m@THIS SECTION		1.468126	Pa/m
TOTAL DROP		1.468126	Pa
		0.15	mmAq
STATIC PRESSURE REGAIN		-14.8727	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741878
2	0.016684	7.741878	6.561000
3	0.023231	6.561000	6.665965
4	0.022505	6.665965	6.656104
5	0.022571	6.656104	6.657026
6	0.022565	6.657026	6.656940
7	0.022566	6.656940	6.656948
8	0.022566	6.656948	6.656947
9	0.022566	6.656947	6.656947
10	**0.022566**	6.656947	6.656947

USE DUCT 380 x 190 mm

ตาราง ผ.6 การคำนวณความดันสูญเสียของสายการไหลที่ 6 ของระบบ Electron Attachment

			REV.	DATE
Project	Emission Gas Treatment (Electron Attachment System)		0	Mar.25'99
LINE	Stream 6	MADE		

STATIC REGAIN DUCT SIZING

DENSITY 0.902 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.019 cP = 0.000019 $N.s/m^2$

	PREVIOUS	THIS	
WIDTH		380	mm
HIGH		190	mm
DIAMETER	12"	304.8	mm
		0.3048	m
AREA		0.072966	m^2
FLOW		1741.8	m^3/hr
VELOCITY		6.630953	m/s
REYNOLDS		95949.76	
LENGTH		5	m
DROP/m@THIS SECTION		1.468126	Pa/m
TOTAL DROP		7.34063	Pa
		0.75	mmAq
STATIC PRESSURE REGAIN		-14.8727	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741878
2	0.016684	7.741878	6.561000
3	0.023231	6.561000	6.665965
4	0.022505	6.665965	6.656104
5	0.022571	6.656104	6.657026
6	0.022565	6.657026	6.656940
7	0.022566	6.656940	6.656948
8	0.022566	6.656948	6.656947
9	0.022566	6.656947	6.656947
10	**0.022566**	6.656947	6.656947

USE DUCT 380 x 190 mm

ตาราง ฌ.7 การคำนวณความดันสูญเสียของสายการไหลที่ 7 ของระบบ Electron Attachment

		REV.	DATE
Project	Emission Gas Treatment (Electron Attachment System)	0	Mar.25'99
LINE	Stream 7	MADE	

STATIC REGAIN DUCT SIZING

DENSITY 1.13 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.018 cP = 0.000018 $N.s/m^2$

	PREVIOUS	THIS	
WIDTH		500	mm
HIGH		250	mm
DIAMETER	16"	406.4	mm
		0.4064	m
AREA		0.129717	m^2
FLOW		4856.6	m^3/hr
VELOCITY		10.39998	m/s
REYNOLDS		265333.6	
LENGTH		5	m
DROP/m@THIS SECTION		3.393202	Pa/m
TOTAL DROP		16.96601	Pa
		1.73	mmAq
STATIC PRESSURE REGAIN		-45.83263	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741878
2	0.016684	7.741878	6.561000
3	0.023231	6.561000	6.665965
4	0.022505	6.665965	6.656104
5	0.022571	6.656104	6.657026
6	0.022565	6.657026	6.656940
7	0.022566	6.656940	6.656948
8	0.022566	6.656948	6.656947
9	0.022566	6.656947	6.656947
10	**0.022566**	6.656947	6.656947

USE DUCT 500 x 250 mm

ตาราง ฌ.8 การคำนวณความดันสูญเสียของสายการไหลที่ 8 ของระบบ Electron Attachment

			REV.	DATE
Project	Emission Gas Treatment (Electron Attachment System)		0	Mar.25'99
LINE	Stream 8	MADE		

STATIC REGAIN DUCT SIZING

DENSITY 1.044 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.019 cP = 0.000019 $N.s/m^2$

	PREVIOUS	THIS	
WIDTH		500	mm
HIGH		250	mm
DIAMETER	16"	406.4	mm
		0.4064	m
AREA		0.129717	m^2
FLOW		6708	m^3/hr
VELOCITY		14.36459	m/s
REYNOLDS		320770.1	
LENGTH		10	m
DROP/m@THIS SECTION		5.980716	Pa/m
TOTAL DROP		59.80716	Pa
		6.11	mmAq
STATIC PRESSURE REGAIN		-80.78269	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741878
2	0.016684	7.741878	6.561000
3	0.023231	6.561000	6.665965
4	0.022505	6.665965	6.656104
5	0.022571	6.656104	6.657026
6	0.022565	6.657026	6.656940
7	0.022566	6.656940	6.656948
8	0.022566	6.656948	6.656947
9	0.022566	6.656947	6.656947
10	**0.022566**	6.656947	6.656947

USE DUCT 380 x 190 mm

ตาราง ฌ.9 การคำนวณความดันสูญเสียภายในถังปฏิกรณ์ของระบบ Electron Attachment

Project	Emission Gas Treatment (Electron Attachment System)		REV.	DATE
			0	Mar.25'99
LINE	Electron Attachment	MADE		

STATIC REGAIN DUCT SIZING

DENSITY 0.902 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.019 cP = 0.000019 $N.s/m^2$

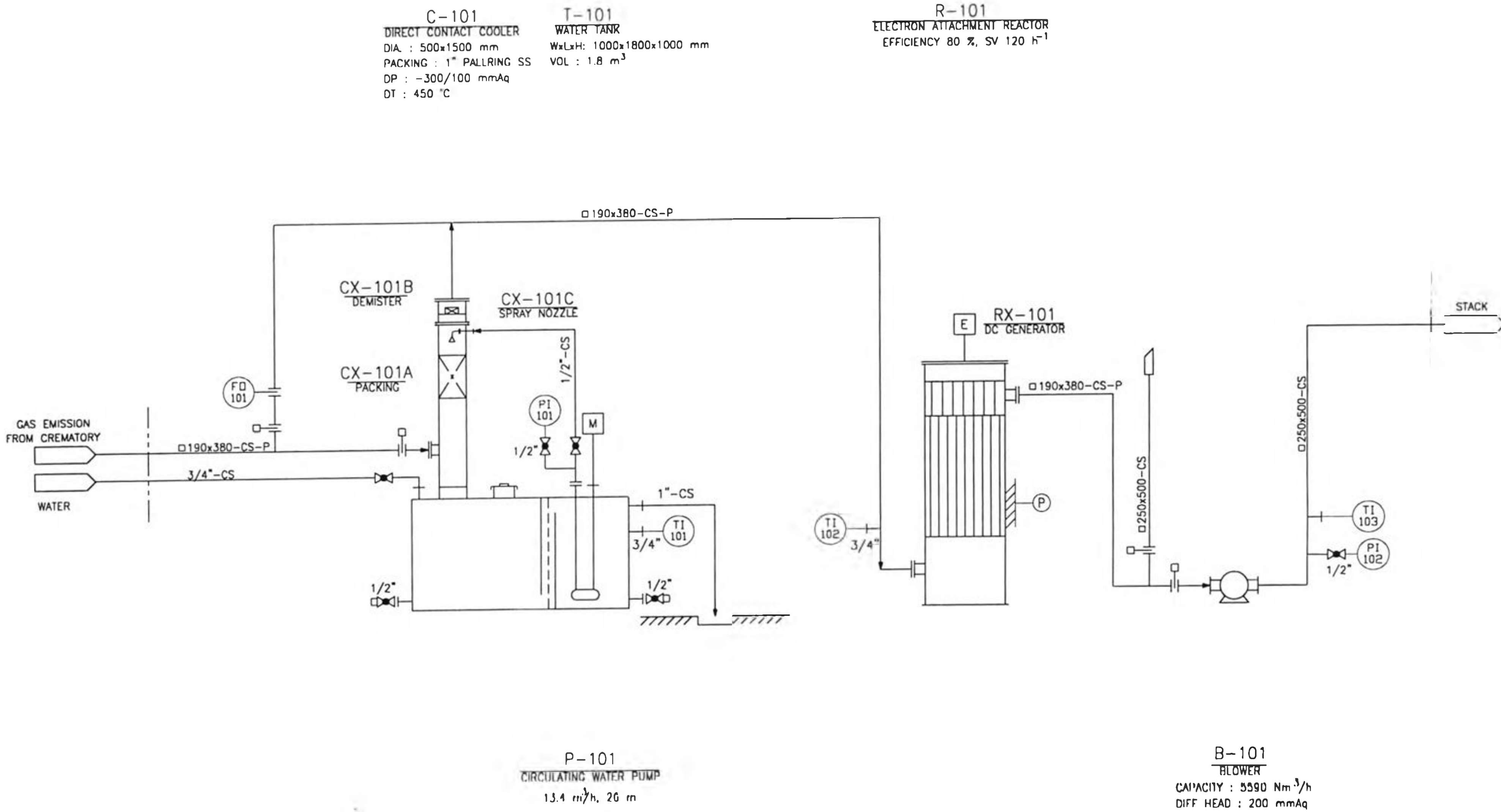
	PREVIOUS	THIS	
WIDTH		-	mm
HIGH		-	mm
DIAMETER	1"	25.4	mm
		0.0254	m
AREA		0.000507	m^2
FLOW		0.2561	m^3/hr
VELOCITY		0.140394	m/s
REYNOLDS		169.292	
LENGTH		3	m
DROP/m@THIS SECTION		0.007898	Pa/m
TOTAL DROP		0.023693	Pa
		0.0024	mmAq
STATIC PRESSURE REGAIN		-0.006667	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741878
2	0.016684	7.741878	6.561000
3	0.023231	6.561000	6.665965
4	0.022505	6.665965	6.656104
5	0.022571	6.656104	6.657026
6	0.022565	6.657026	6.656940
7	0.022566	6.656940	6.656948
8	0.022566	6.656948	6.656947
9	0.022566	6.656947	6.656947
10	**0.022566**	6.656947	6.656947

USE DUCT - x - mm

ต้นฉบับ หน้าขาดหาย



แบบแสดงท่อและอุปกรณ์วัดคุม.

Rev	Date	Made	hecked	Approved
0	Feb,09,199	N.A	N.A	

EQUIPMENT LIST

Plant: Emission Gas Treatment — Sheet 1 of 1

System: Electron Attachment System

	ITEM NO.	NAME	NO. REQ'D		DESIGN CONDITION		OPERATING CONDITION		FLUID	TYPE	SPECIFICATIONS	MATERIAL	MOTOR	ELEC.	REMARKS
			W	S	PRESS. barG	TEMP. °C	PRESS. barA	TEMP. °C					kW	kW	
1	R-101	Electron Attachment Reactor	1	-	-300/100 mmAq	200	-100 mmAq	150	Emission Gas	Electron Attachment	No,of tube 6800,CS Tube Dia 1"x3000 mm	CS/SS	-	-	
2	RX-101 -A~G	DC Generator	7	-	-	-	-	-	-	DC Generator	0~15 KV,0.4A	-	-	12	
3	C-101	Direct Contact Cooler	1	-	-300/100 mmAq	450	-200 mmAq	400/150	Emission Gas / Water	Packed Plate	Dia,500 mm x 1500 mm	CS	-	-	
4	CX-101 A	Packing	1	-	-300/100 mmAq	450	-200 mmAq	400/150	Emission Gas / Water	1" Pall Ring	Pack Height 500 mm	304LSS	-	-	
5	CX-101 B	Demister	1	-	-300/100 mmAq	450	-200 mmAq	400/150	Emission Gas / Water	Wire Mesh	80 Kg/m^3	304LSS	-	-	
6	CX-101 C	Spray Nozzle	1	-	3	60	2	30	Water	Full Cone	13,4 m^3/h , 60°, 2" NPT	Brass	-	-	
7	T-101	Water Tank	1	-	FW	60	ATM	30~40	Water	Rectangular w/ Partition and Wire Mesh 40	1000 x 1000 x 1800 mm Volume 1,8 m^3	CS	-	-	
8	P-101	Water Pump	1	-	3	60	2.6	30	Water	Sump	13,4 m^3/h , 26 m , 2.2 KW	CS/316SS	3		
9	B-101	Blower	1	-	-300/100 mmAq	200	-200 mmAq	54	Treated Gas	Centrifugal	5590 Nm^3/h , 200 mmAq 5,5 KW , 380 V , 3 Ph , 50 HZ	CS/CS	7.5		

แบบแสดงรายการของอุปกรณ์ในระบบ

	PLANT : EMISSION GAS TREATMENT
DESIGN DATA	ITEM NO. : C-101

CODE	[ ] ASME/ANSI RTP-1	[ ] JIS B 824	[X] NONE
DESIGN PRESS.	-0.05 bar / FW		
DESIGN TEMP.	450		°C
CORROSION ALLOWANCE	1.0		mm
HYDRO. TEST PRESS.	[ ] AS PER CODE	[X] FW kg/cm²G	
PNEUM. TEST PRESS.	[ ] AS PER CODE	[X] NONE kg/cm²G	
POST WELD HEAT TREATMENT	[ ] AS PER CODE	[ ] YES	[X] NONE
RADIOGRAPHY	[*] AS PER CODE	[X] NO	
LONG JOINT EFFICIENCY	[ ] AS PER CODE	[X] 0.7	
INSULATION	[ ] HOT [ ] COLD	[X] P.P. (MM)	[ ] NO
WIND PRESSURE	None		
EARTHQUAKE FACTOR	None		

SERVICE NAME : DIRECT CONTACT COOLER

WEIGHT & CAPACITY

ERECTION WEIGHT	200	kg
OPERATING WEIGHT	200	kg
FULL WATER WEIGHT	790	kg
CAPACITY	0.6	m³

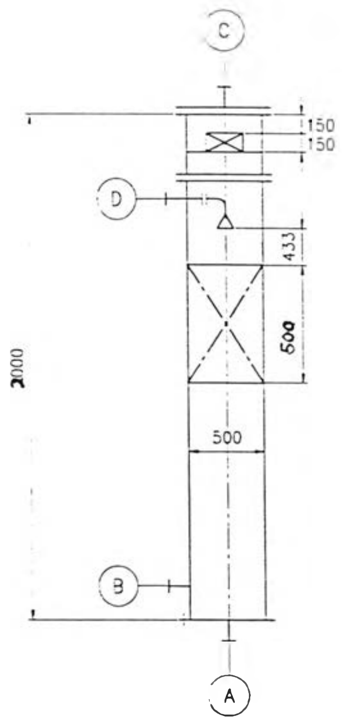
MATERIAL SPECIFICATIONS

SHELL & HEAD	CS
SUPPORTS	CS
INTERNALS	SS
NOZZLE NECKS	CS
FLANGES	CS
BOLTS & NUTS	CS
GASKETS	CAF

NOZZLE SCHEDULE

[X] ANSI B16.5
[ ]

MARK	NO. REQ'D	SIZE	RATING	TYPE	FACING	DESIGNATION
A	1	20"	Welding End			WATER OUTLET
B	1	10"	Cal		FF	GAS INTLET
C	1	8"	Cal		FF	GAS INTLET
D	1	2"	# 150	SW	RF	WATER INTLET



REV.	DWG	CHK	GL	SC	MGR	APPR	DATE	DESCRIPTION
2								
1								
0								FOR PROPOSAL

DWG. NO.

แบบแสดงข้อมูลของหอทำความเย็นแบบสัมผัสตรง(C-101)

PLANT :	EMISSION GAS TREATMENT
ITEM NO. :	T-101
SERVICE NAME :	WATER TANK

DESIGN DATA

CODE	[ ] ASME/ANSI RTP-1	[ ] JIS B 824	[X] NONE
DESIGN PRESS.	FW		
DESIGN TEMP.	60		°C
CORROSION ALLOWANCE	1.0		mm
HYDRO. TEST PRESS.	[ ] AS PER CODE	[X] FW kg/cm²G	
PNEUM. TEST PRESS.	[ ] AS PER CODE	[X] NONE kg/cm²G	
POST WELD HEAT TREATMENT	[ ] AS PER CODE	[ ] YES	[X] NONE
RADIOGRAPHY	[ ] AS PER CODE	[X] NO	
LONG JOINT EFFICIENCY	[ ] AS PER CODE	[X] 0.7	
INSULATION	[ ] HOT [ ] COLD	[X] P.P. (MM)	[ ] NO
WIND PRESSURE	None		
EARTHQUAKE FACTOR	None		

WEIGHT & CAPACITY

ERECTION WEIGHT	256	kg
OPERATING WEIGHT		kg
FULL WATER WEIGHT		kg
CAPACITY	1.6	m³

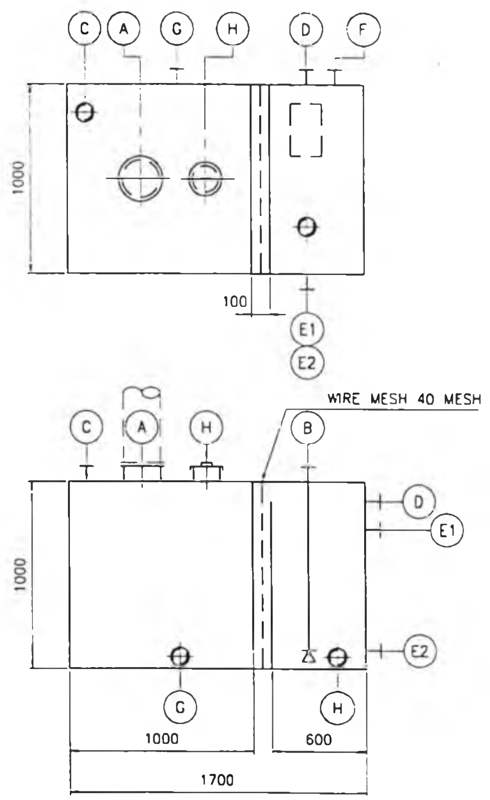
MATERIAL SPECIFICATIONS

SHELL & HEAD	CS
SUPPORTS	CS
INTERNALS	CS / SS
NOZZLE NECKS	CS
FLANGES	CS
BOLTS & NUTS	CS
GASKETS	CAF

NOZZLE SCHEDULE

[X] ANSI B16.5
[ ]

MARK	NO. REQ'D	SIZE	RATING	TYPE	FACING	DESIGNATION
A	1	20"	Weldind End			WATER INTLET
B	1	24"	# 150	SW	RF	WATER OUTLET
C	1	3/4"	# 150	NPT	NPT	MAKE UP WATER
D	1	1"	# 150	NPT	NPT	OVERFLOW
E1/2	2	3/4"	# 150	NPT	NPT	LG CONN.
F	1	3/4"	# 150	NPT	NPT	DRAIN
G	1	3/4"	# 150	NPT	NPT	DRAIN
H	1	8"	# 150	NPT	NPT	HANDHOLE
I	1	3/4"	# 150	NPT	NPT	TI CONN.



REV.	DWG	CHK	GL	SC	MGR	APPR	DATE	DESCRIPTION
2								
1								
0								FOR PROPOSAL

DWG. NO.

T-101

แบบแสดงข้อมูลของถังเก็บน้ำ(T-101)

PLANT :	EMISSION GAS TREATMENT
ITEM NO. :	R-101
SERVICE NAME :	ELECTRON ATTACHMENT REACTOR

DESIGN DATA

CODE	[ ] ASME/ANSI RTP-1	[ ] JIS B 824	[X] NONE
DESIGN PRESS.	-0.05 bar / FW		
DESIGN TEMP.	450		°C
CORROSION ALLOWANCE	1.0		mm
HYDRO. TEST PRESS.	[ ] AS PER CODE	[X] FW kg/cm²G	
PNEUM. TEST PRESS.	[ ] AS PER CODE	[X] NONE kg/cm²G	
POST WELD HEAT TREATMENT	[ ] AS PER CODE	[ ] YES	[X] NONE
RADIOGRAPHY	[ ] AS PER CODE	[X] NO	
LONG JOINT EFFICIENCY	[ ] AS PER CODE	[X] 0.7	
INSULATION	[ ] HOT [ ] COLD	[X] P.P. (MM)	[ ] NO
WIND PRESSURE	None		
EARTHQUAKE FACTOR	None		

WEIGHT & CAPACITY

ERECTION WEIGHT	43690	kg
OPERATING WEIGHT	43690	kg
FULL WATER WEIGHT	63690	kg
CAPACITY	18.5	m³

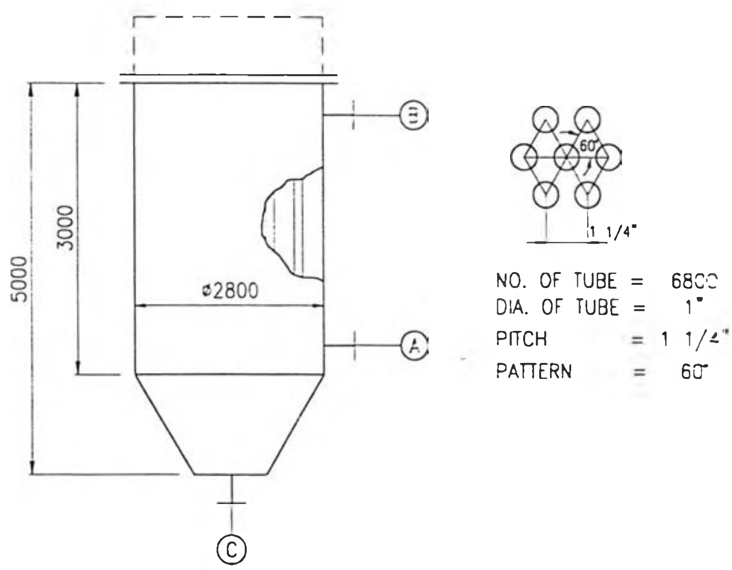
MATERIAL SPECIFICATIONS

SHELL & HEAD	CS
SUPPORTS	CS
INTERNALS	CS
NOZZLE NECKS	CS
FLANGES	CS
BOLTS & NUTS	CS
GASKETS	CAF

NOZZLE SCHEDULE

[X] ANSI B16.5
[ ]

MARK	NO. REQ'D	SIZE	RATING	TYPE	FACING	DESIGNATION
A	1	190X380	Cal		FF	GAS INLET
B	1	190X380	Cal		FF	GAS OUTLET
C	1	20"	Cal		FF	DUST OUTLET



REV.	DWG	CHK	GL	SC	MGR	APPR	DATE	DESCRIPTION
2								
1								
0								FOR PROPOSAL

DWG. NO.

R101

แบบแสดงข้อมูลของถังปฏิกรณ์ (R-101).

CENTRIFUGAL PUMP
DATA SHEET

Customer		Rev.	Date	Made	Chkd.	Auth.	Dscrpt
Plant Location							
Unit							
Purchaser	Work No.						
Item No. P-101	Req. No.						
Service of Unit Water Pump							
No.Req'd Working 1 Standby - Total 1		0	Mar25,1999	N.A			

OPERATING CONDITIONS

		Rev.
LIQUID WATER	FLOW NOR. 13.3 m3/h RATED 16 m3/h	
CORR./ERO. BY	PRESSURE	
PUMP.TEMP. 30 MIN. MAX. 40 degC	DISCH. 2.569 barG	
SPEC.GRAV.@PT 0.992 MAX. 0.995	SUCT.RATED 0 MAX. barG	
VAPOR PRESS.@PT 0.042 barA	DIFF. 2.569 bar	
VISCOSITY @PT 0.66 mPa.s	TOTAL HEAD 25.9 m	
	NPSH AVAIL. 9.9 m	
CONSTRUCTION	INSTALLATION ( ) INDOOR ( ) OUTDOOR	

CONSTRUCTION	MATERIALS
MFR MODEL ESP2	
TYPE ( ) HOR. (X) VERT. ( ) SELF PRIMING	
CASE MT. ( ) BRACK (X) C-LINE ( ) FOOT ( ) VERT.	CODE: CASE INTRN.
VERT. ( ) INLINE ( ) BARREL (X) SUMP ( ) SUBMERG.	CASE DUCTILE IRON
CASE TYPE ( ) SINGLE-VOL. ( ) DBL-VOL. ( ) DIFFUSER	IMPELLER/INDUCER CS /
CASE SPLIT ( ) AXIAL ( ) RADIAL ( ) RING-SECT	CASE WRG RING HARD.

NOZZLE	SIZE	RATING	FACE	POSITION	MATERIALS (cont.)
					IMP.WRG RING TEFLON HARD.
SUCTION					SHAFT STEEL
DISCH.	1 1/2"		NPT	TOP	SLEEVE

CONSTRUCTION (cont.)	MATERIALS / PERFORMANCE
NO.OF STAGES: 1 ( ) OVHG ( ) BET-BRG	CASE GASKET
IMPELLER : ( ) CLOSED ( ) SEMI-OPEN ( ) OPEN	( ) LINING
(X) SINGLE SUCT. ( ) DBL SUCT. ( ) W/INDUCER	**PERFORMANCE**
DIA.DES. mm MAX/MIN mm	
WRG RING DIA mm CLEAR. mm	
BRG RADIAL Ball NO	SPEED rpm NPSH REQ. (WTR) m
THRUST Ball NO	RATED EFF % RATED BHP kW
DN VALUE mm.rpm	MIN.FLOW TH. ST. m3/h
LUBE ( ) RING OIL ( ) FLOOD ( ) FLING ( ) PRESS	FLOW RATE @ BEP m3/h
( ) GREASE ( ) PURE MIST ( ) PURGE MIST	MAX.OPE.PRESS. barG
POWER TRANS MISSION (X) DIRECT ( ) GEAR ( ) V-BELT	CASE DES. TEMP. degC PRESS. barG
CPLG ( ) FLEX. ( ) GEAR ( ) DISK ( ) RIGD ( ) SPACER	HYDRO. TEST PRESS. barG
MFR MODEL	PNEUM. TEST PRESS. barG
ROTATION VIEWED FROM CPLG END ( ) CW ( ) CCW	SUCT.SP.SPEED rpm.m3/m.m
BASEPLATE (X) COMMON ( ) SOLE ( ) SEPARATE	PUMP CASE JACKET ( ) FULL ( ) PARTIAL

SHAFT SEAL ( ) NON-SEAL ( )	SEALING PRESS. barG
( ) PACKING :MFR MAT'L	NO.OF RINGS
( ) MECH.SEAL :MFR	MODEL
TYPE Double API CODE	MFR'S CODE
MAT'L :FACES VS METAL	GASKET

AUXILIARY PIPING		INLET CONDITIONS		FLOW	PLAN NO.	MAT'L	CONNECTIONS		
SERVICE	FLUID	barG	degC	m3/h		(#1)	SIZE	RATING	FACE

TAPPED OPENG ( ) VENT ( ) VALVE ( ) CAP ( ) PLUG ( ) FLANGE (SIZE RATE FACE
( ) DRAIN ( ) VALVE ( ) CAP ( ) PLUG ( ) FLANGE (SIZE RATE FACE)
AUTOMATIC ( ) START ( ) STOP BASEPLATE SIZE m X
VERT.PUMP: (X) SUMP LENGTH 1 m (X) W/SUCT.STRAINER ( ) THRUST (UP/DOWN) kg
MASS:PUMP 136 kg BASE kg MOTOR 12 kg TURB. kg

ELECT. MOTOR NO. (1)	TURBINE (ITEM NO.)
SUPPL.BY Vendor MOUNT.BY Vendor	SUPPL.BY MOUNT.BY
MFR TYPE	MFR TYPE
RATED OUTPUT 2.2 kW	RATED OUTPUT kW RPM
SPEED 2900 rpm POLES 2	APPL.ENG.SPEC
PHASE 3 HZ 50 VOLT 380	CODE.STANDARD
HAZARD.AREA CLASS None	

REMARKS:

แบบแสดงข้อมูลของปั๊มปี (P-101).01.xls

DATA SHEET FOR CENTRIFUGAL BLOWER

REV	LINE	DATE	A/E	CHIEF	MGR.	PE.	PEM	PM.
0		Mar26'99	N.A					
1								
2								
3								
4								
5								

CUSTOMER
LOCATION
UNIT Gas Treatment System
SUPPLIER JOB NO.
ITEM NO. B-101 REQ'N NO.
SERVICE
NO. REQ'D (WORKING 1 STAND-BY - TOTAL 1)

OPERATING CONDITIONS

GAS COMPOSITION Treated Gas
SOLID AT SUCTION (g/Nm³)
R. H. AT SUCTION (%)
MOLECULAR WEIGHT 28.45
SPEC. WEIGHT AT SUCTION 1.044 (kg/m³)
COMP. FACTOR (Z)

CAPACITY 5590 Nm³/h DRY BASE
m³/hr/ AT SUCTION
TEMP. SUCTION 54.7 (°C)
DISCHARGE 54 (°C)
PRESS. DISCHARGE (STATIC) 0 mmAqG
SUCTION RATED (STATIC) -200 mmAqG
DIFF. (STATIC) 200 mmAq
INSTALLATION [ ] INDOOR [X] OUTDOOR

CONSTRUCTIONS

MFR. # MODEL FY-15BCD-B
TYPE [X] CENTRIF-BACKWARD [ ] CENTRIF-RADIAL
[ ] MULTI-BLADE [ ] MIXED FLOW [ ] AXIAL
CASE : MOUNT [ ] BRACKET [ ] FOOT [ ] C-LINE [ ] CAST
: SPLIT [ ] AXIAL [ ] RADIAL
: CONSTRUCTION [X] FABRICATED [ ] CAST
DIA. VALUE

NOZZLE	SIZE	RATING	FACING	POSITION
SUCTION	#	#	FF	END
DISCH.	#	#	FF	TOP

WHEEL NO. [ ] OVHG [ ] BET-BRG
TYPE [ ] CLOSED [ ] SEMI-OPEN [ ] OPEN
SUCTION [X] SINGLE [ ] DOUBLE
HUB FIT
CONSTRUCTION [ ] FABRICATED [ ] CAST
DIA. (mm.) CLEARANCE (mm.)
BLADE TYPE [ ] HOLLOW [ ] SOLID AIRFOIL
[ ] SINGLE-THICK. NO. OF BLADES
BEARING RADIAL NO.
TURUST NO.
BEARING HOUSE CONSTRUCTION
LUBE [ ] OIL RING [ ] FLOOD [ ] FLING [ ] PRESS
[ ] GREASE [ ] MIST-PURE [ ] MIST-PURGE
POWER TRANS [ ] DIRECT [ ] GEAR [ ] V-BELT [ ] SPD'VAR
COUPLING [ ] FLEX [ ] RIGID [ ] F-DISK [ ] SPACER
MFR MODEL
ROTATION VIEWED FROM CPL'G END [ ] CW [ ] CCW
BASEPLATE [X] COMMON [ ] SOLE [ ] SEPARATE
[ ] GROUTING REQUIREMENT
NOZZLE ORIENTATION TYPE NO.
APPL. ENG. SPEC
CODE/STANDARD

MATERIALS

CODE	CASE	INTERNAL
CASE/HOUSING		
IMPELLER	SS41	
SHAFT	S35C	
SLEEVE		
GASKET		
LABYRINTH		
BASEPLATE	SSC41	
[ ] LINING		

PERFORMANCE

SPEED (rpm) EFF. (STATIC) (%)
BHP RATED AT MIN. TEMP. (kW)
SUCTION [ ] NET [ ] FILTER [ ] SILENCER
MFR TYPE
PD CLEAN MAX. (mmAq)
[ ] SUCTION DAMPER [ ] DISCHARGE DAMPER
CONTROL [ ] MAN. [ ] AUTO.
SIGNAL [ ] ELEC [ ] PNEUM RANGE (%)
MAX. OPERATING RPESS. (mmAqG)
CASE DES. PRESS (kg/cm□G TEMP. (□C)
[ ] CASE HYD. TEST PRESS. (kg/cm□G)
TYPE OF SEAL
[ ] MEACH. SEAL MFR
MODEL NO. OF SEAL
TYPE API CODE
MFR'S CADE
MAT'L FACE VS
METAL GASKET
OTHER SEAL MFR
MODEL NO. OF RING
MATERIAL

AUX CONNECTIONS SERVICE	FLUID	INLET CONDITION (kg/cm□G)	(□C)	SP.GR	FLOW (m□/h)	MATERIAL (#1)	CONNECTIONS SIZE	RATING	FACE

TAPPED OPENING [ ] DRAIN [ ] VALVE [ ] CAP [ ] PLUG [ ] FLANGE (SIZE RATE FACE
SPACE REQ'T (L•W•H) (m) HAZARD. CLASS
NOISE LEVEL (dBA@lm) [ ] ACOUST ENCLOSURE SUPPLIED BY VENDOR
WEIGHT (kg) BLOWER BASE MOTOR

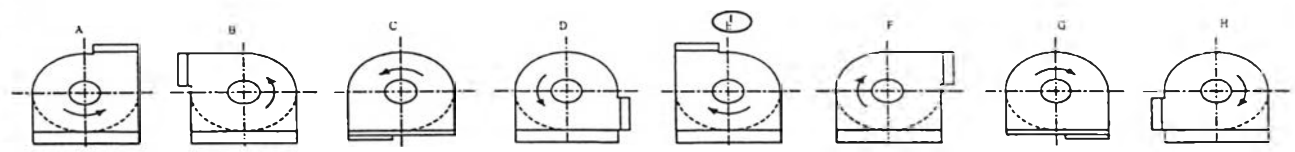
MOTOR

SUPPLIED BY VENDOR MOUNTED BY VENDOR
MFR. TYPE TEFC
RATED OUTPUT 5.5 (kW) POLE
SPEED (rpm)
PHASE 3 CYCLE 50 VOLTS 380
INSULATION CLASS IP
HAZARDOUS AREA CLASS -

TURBINE

SUPPLIED BY MOUNTED BY
MFR. TYPE
RATED OU kW (kW) SPEED (rpm)
INLET STEAM (kg/cm□G) (□C)
EXHAUST (kg/cm□ G)
BRG LUBE
STEAM RATE (kg) AT RATED

NOZZLE ORIENTATION VIEWED FROM CPL'G END



REMARKS

แบบแสดงข้อมูลของพัดลม (B-101).

			PACKING DATASHEET		
1	**CUSTOMER**			**DATE**		
2	**LOCATION**			AUTH. BY	CHKD. BY	MADE BY
3	**UNIT**					
4	**SUPPLIER**		**JOB NO.**	REV. DATE	LINE NO.	BY
5	**ITEM NO.**	CX-101A	**REQ. NO.**			
6	**SERVICE**	PACKING				
7	**NO. REQ'D**	1 **STAND BY** - **TOTAL** 1				

10	TYPE	:	RASCHIG RING
11	SIZE	:	1"
12	CAPACITY	:	0.1 M^3
13	MATERIAL	:	SS 304L

แบบแสดงข้อมูลของแพค (CX-101A)..

		DEMISTER DATASHEET		
CUSTOMER		**DATE**	APR.15,1999.	
LOCATION		AUTH. BY	CHKD. BY	MADE BY
UNIT				
SUPPLIER	**JOB NO.**	REV. DATE	LINE NO.	BY
ITEM NO. CX-101B	**REQ. NO.**			
SERVICE DEMISTER				
NO. REQ'D 1 **STAND BY** - **TOTAL** 1				

APPLICATION	:	DIRECT CONTACT COOLER
PURPOSE	:	OVERHEAD QUALITY SEPERATED ENTRAINED
		LIQUID DROPLET FROM GAS
OPERATING CONDITION	:	-100 mmAq
		150 ^{0}C
		1741.8 m^3/h
SPECIFICATION	:	
-STYLE	:	421
-DIAMETER	:	420 mm
-THICKNESS	:	150 mm
-MATERIAL	:	304LSS
-SPECIAL HOUSING	:	YES

แบบแสดงข้อมูลของอุปกรณ์กำจัดละออง (CX-101B).

			SPRAY NOZZLE DATASHEET		
1	**CUSTOMER**		**DATE**		
2	**LOCATION**		AUTH. BY	CHKD. BY	MADE BY
3	**UNIT**				
4	**SUPPLIER**	**JOB NO.**	REV. DATE	LINE NO.	BY
5	**ITEM NO.** CX-101C	**REQ. NO.**			
6	**SERVICE** SPRAY NOZZLE				
7	**NO. REQ'D** 1 **STAND BY** - **TOTAL** 1				

8			
9	MANUFACTURER	:	
10	MODEL	:	
11	TYPE	:	60° FULL CONE
12	CAPACITY	:	13.5 m^3/h
13	PRESSURE INLET	:	2 BAR G.
14	DENSITY	:	995 kg/m^3
15	VISCOSITY	:	0.8 cP
16	MATERIAL	:	BRASS
17	APPROXIMATE WEIGHT	:	2.7 kg
18	ACCESSORIES	:	
19			
20			
21			
22			
23			
24			
25			
26			
27			
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29			
30			
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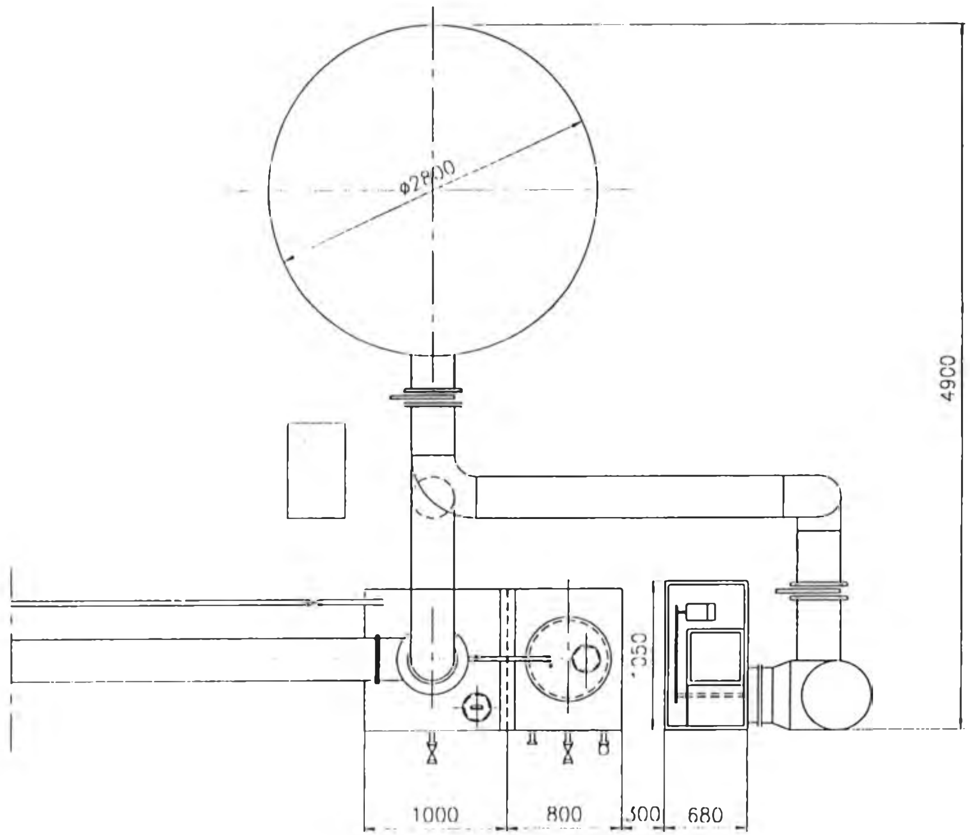
32			
33			
34			
35			

แบบแสดงข้อมูลของหัวฉีดละออง (CX-101C).

			DC GENERATOR DATASHEET		
CUSTOMER			**DATE**	APR.15,1999.	
LOCATION			AUTH. BY	CHKD. BY	MADE BY
UNIT					
SUPPLIER		**JOB NO.**	REV. DATE	LINE NO.	BY
ITEM NO.	RX-101	**REQ. NO.**			
SERVICE	DC GENERATOR				
NO. REQ'D	7 **STAND BY** - **TOTAL** 7				

TYPE	:	DC GENERATOR
INPUT DATA		
-VOLTAGE	:	220 V
-FREQUENCY	:	50 HZ
OUTPUT REQUIREMENT		
-VOLTAGE	:	0~20 KV
-CURRENT	:	0~ 0.4mA
-ADJUSTABLE VOLTAGE	:	YES
-ADJUSTABLE AMPARE	:	YES
-STABILITY SYSTEM	:	YES

แบบแสดงข้อมูลของเครื่องกำเนิดไฟฟ้ากระแสตรง (RX101AG).



แบบแสดงผังตำแหน่งของอุปกรณ์.

LAY-OUT DRAWING
OF
GAS EMISSION TREATMENT SYSTEM

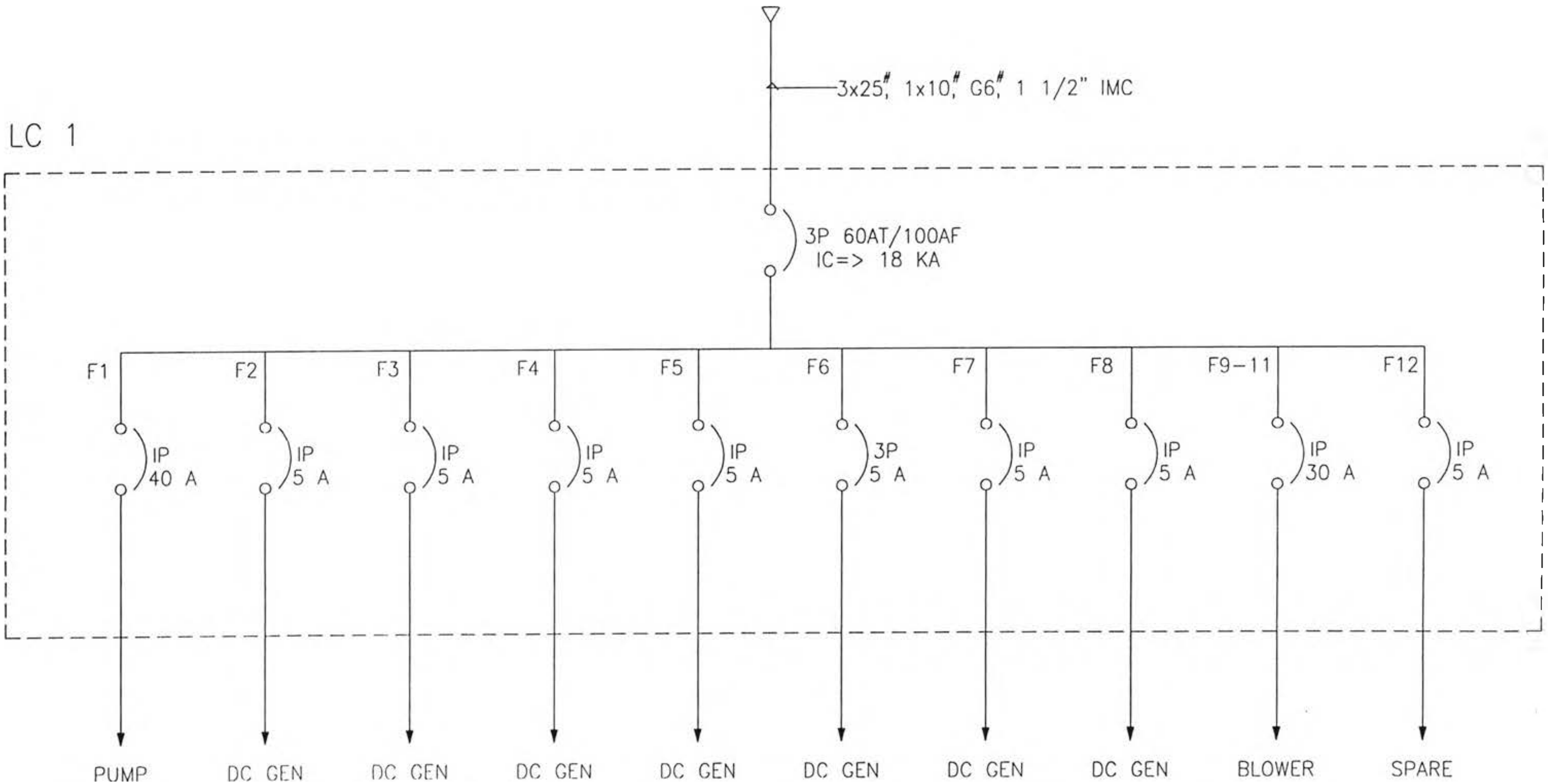
Rev	Date	Made	Checke	Aprr
0	04/06/99	N.A	N.A	

ELECTRICAL CONSUMPTION LIST

Plant Emission Gas Treatment
System Electron Attachment System

NO.	ITEM NO.	NAME	NO. REQ'D		Capacity (KW)	Phase	Voltage (V)	Frequency (Hz)	Motor Type	Start Method	Speed (rpm)	REMARKS
			W	S								
1	P-101	Water Pump	1	-	2.2	3	380	50	Vertical TEFC,Outdoor	Direct on-line	1450	
2	B-101	Blower	1	-	7.5	3	380	50	Horizontal TEFC,Outdoor	Direct on-line	2900	
3	RX-101	DC Generator	1	-	12.5	1	220	-	-	-	-	

แบบแสดงรายการใช้ไฟฟ้าของอุปกรณ์ในระบบ:



แบบแสดงผังไฟฟ้าสายเดียว.

INSTRUMENT DATA SHEET (TEMPERATURE)

System : Electron Attachment
Sheet No. : 1/1
Rev : 0
Rev Date : Apr.06, 1999
Made By : N.A

1	STREAM No.	-	5	8	
2	TAG No.	TI 101	TI 102	TI 103	
3	QUANTITY	1	1	1	
4	SERVICE	T-101	R-101 Inlet	B-101 Outlet	
5	PHASE	Liquid	Gas	Gas	
6	DESIGN TEMPERATURE, °	60	400	400	
7	DESIGN PRESSURE, BAR	FW	-200 mmAq	100 mmAq	
8	OPER. PRESSURE, BAR A	ATM	-100 mmAq	25 mmAq	
15	MAX. TEMP., °C	50	400	400	
16	NOR. TEMP., °C	40	150	54.7	
17	MIN. TEMP., °C	30	-	-	
18	ALARM ACTION	-	-	-	
19	ALARM SET POINT, °C	-	-	-	
20	METER RANGE, °C	0~100	0~400	0~400	
21	SPECIAL INSTRUMENT TY	Bi-Metal	Bi-Metal	Bi-Metal	
22	SPECIAL MATERIAL	-	-	-	
23	LINE SIZE, INCH	3/4	3/4	3/4	
24	LINE CLASS	-	-	-	
25	REMARKS	-	-	-	
26	P & ID No.	1	1	1	

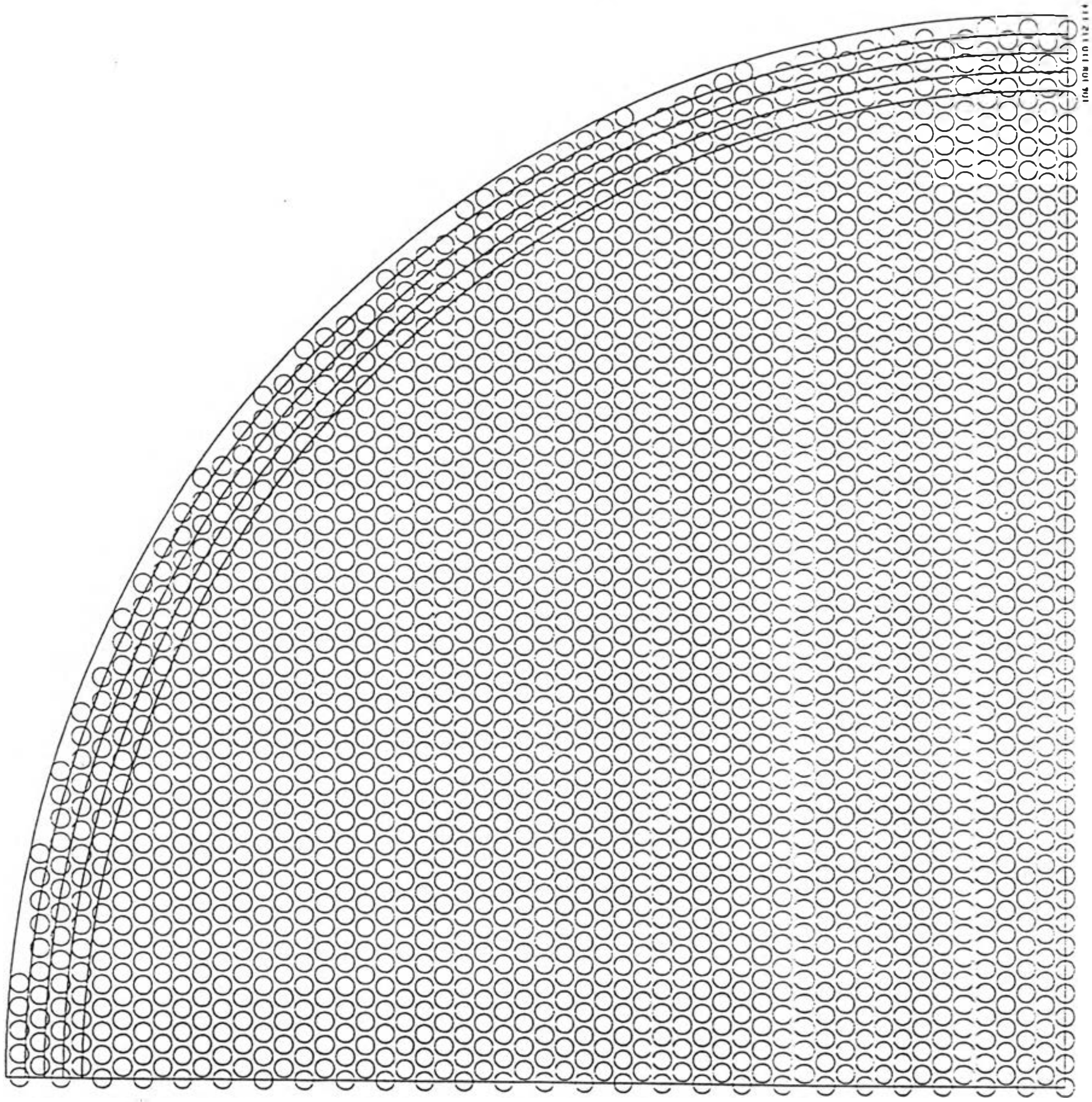
แบบแสดงอุปกรณ์วัดคุมอุณหภูมิ..

INSTRUMENT DATA SHEET (PRESSURE)

System : Electron Attachment
Sheet No. : 1/1
Rev : 0
Rev Date : Apr.06, 1999
Made By : N.A

1	STREAM No.	9	8		
2	TAG No.	PI 101	PI 102		
3	QUANTITY	1	1		
4	SERVICE	P-101	Air to Stack		
5	FLUID	Water	Treated Gas		
6	PHASE	Liquid	Gas		
7	DESIGN TEMPERATURE,	60	150		
8	OPER. TEMPERATURE, °	30-40	54.7		
9	DESIGN PRESSURE, BAR	3	200 mmAq		
10	MAX. PRESSURE, BAR A	3	50 mmAq		
11	NOR. PRESSURE, BAR A	2.6	25 mmAq		
12	MIN. PRESSURE, BAR A	-	0 mmAq		
13	ALARM ACTION	-	-		
14	ALARM SET POINT,BAR A	-	-		
15	METER RANGE, BAR G	0 ~ 6	-200 ~200 mmAq		
16	SPECIAL INSTRUMENT TY	Bourdon	Barometer		
17	SPECIAL MATERIAL	-	-		
18	LINE SIZE, INCH	1/2	1/2		
19	LINE CLASS	CS	CS		
20	REMARKS	-	-		
21	P & ID No.	1	1		

แบบแสดงอุปกรณ์วัดคุมความดัน..



แบบแสดงการจัดเรียงจำนวนท่อของถังปฏิกรณ์.

ภาคผนวก ฎ สรุปการคำนวณสมการการเผาไหม้ของก๊าซเชื้อเพลิงของระบบ After Burning

ตาราง ฎ 1 เอนธาลปีจากการเผาไหม้ก๊าซเชื้อเพลิง

Theoritical Combustion : of LPG (Propane)	$C_3H_8 + 5O_2 + 18.8\ N_2 + 0.88\ H_2O \longrightarrow 3\ CO_2 + 4\ H_2O + 18.8\ N_2$	
Reference Temperature :	298	K
Heating Value of Propane :	2212989	KJ/Kmol
Fuel Supply :	0.24	Kmol/h
Combustion Enthalpy :	521524.0	KJ/h

No	Component	MW	Enthalpy Formula $a(T-T_r)+b/2(T^2-T^2_r)$		Molar Generated (Kmol/h)	$b/2(T^2-T^2_r)$	a(T-Tr)	$a(T-T_r)+b/2(T^2-T^2_r)$	Flame Temp.	
			a	b					(K)	(°C)
1	N_2	28	29.231	0.00307	4.430502	0.0068 (T^2-298^2)	129.51 (T-298)	0.014338 T^2+ 198.19 T -581858	2488	2215
2	H_2O	18	32.477	0.00862	1.1500452	0.00496 (T^2-298^2)	37.35 (T-298)			
3	CO_2	44	44.319	0.00730	0.706995	0.00258 (T^2-298^2)	31.33 (T-298)			
4	O_2	32	30.504	0.00349	0	0 (T^2-298^2)	0.00 (T-298)			
	Subtotal				6.2875422	0.01434 (T^2-298^2)	198.19 (T-298)			

ตาราง ฎ 2 สมดุลพลังงานของการเผาไหม้ก๊าซเชื้อเพลิง

Theoritical Combustion of LPG (Propane) : $C_3H_8 + 5O_2 + 18.8\ N_2 + 0.88\ H_2 \longrightarrow 3\ CO_2 + 4\ H_2O + 18.8\ N_2$

Reference Temperature : 298 K

					Inlet Stream							Outlet Stream		
No	Component	MW	Enthalpy Formula $a(T-T_r)+b/2(T^2-T^2_r)$		Emission Gas Condition			Fuel Condition				Flue Gas Outlet		
			a	b	molar (Kmol/h)	Temp. (K)	Enthalpy (KJ/h)	Fuel Supply (Kmol/h)	Theo. molar (Kmol/h)	Temp. (K)	Enthalpy (KJ/h)	molar (Kmol/h)	Temp. (K)	Enthalpy (KJ/h)
1	N_2	28	29.231	0.00307	36.70	673	422804	0.24	18.80	2488	325116.6	41.13	888.6	754315.5
2	H_2O	18	32.477	0.00862	6.67	673	91701	0.24	4.88	2488	112039	7.82	888.6	173616
3	CO_2	44	44.319	0.00730	6.20	673	111282	0.24	3.00	2488	84365	6.91	888.6	198457
4	O_2	32	30.504	0.00349	2.92	673	35257	0.24	0	2488	0	2.92	888.6	56177
	Subtotal				52.49		661044		6.29		521520.3	58.78		1182565
					Total Molar (Kmol/h)						58.78	Total Molar (Kmol/h)		58.78
					Total Enthalpy (KJ/h)						1182565	Total Enthalpy (KJ/h)		1182565

ภาคผนวก ฎ สมดุลมวลสารขององค์ประกอบของก๊าซทิ้งหลังปฏิกิริยาการเผาไหม้ของระบบ After Burning

ตาราง ฎ 1 สมดุลมวลสารขององค์ประกอบของก๊าซทิ้งหลังปฏิกิริยาการเผาไหม้ของระบบ

After Burning

Total Emission Gas Inlet :	1512.2	Kg/h	52.43	Kmol/h
Total Flue Gas out of After Burner :	1687.9	Kg/h	58.71	Kmol/h
Av. Conc. of NOx Inlet :	8000	ppm	0.4195	Kmol/h
Av. Conc.of SOx Inlet :	580	ppm	0.0304	Kmol/h

NO.	Component	Theo. Combustion Formula	Conc in		Conc out		NOx Comb Prod	SOx Comb Prod
			(ppm)	(Kmol/h)	(ppm)	(Kmol/h)	(Kmol/h)	(Kmol/h)
1	Acetic Acid	$CH_3COOH + 2O_2 \longrightarrow 2CO_2 + 2H_2O$	2400	0.12584	21.43465	0.00126	0.00000	0.00000
2	Propane	$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$	23000	1.20598	0.00000	0.00000	0.00000	0.00000
3	Acetaldehyde	$CH_3CHO + 5/2O_2 \longrightarrow 2CO_2 + 2H_2O$	4	0.00021	0.03572	0.00000	0.00000	0.00000
4	Stryrene	$C_6H_5CH{=}CH_2 + 10O_2 \longrightarrow 8CO_2 + 4H_2O$	1	0.00005	0.00893	0.00000	0.00000	0.00000
5	Hydrogen Sulfide	$H_2S + 3/2O_2 \longrightarrow SO_2 + H_2O$	1	0.00005	0.00893	0.00000	0.00000	0.00005
6	Methyl Mercaptan	$CH_3SH + 3O_2 \longrightarrow SO_2 + CO_2 + 2H_2O$	0.1	0.00001	0.00089	0.00000	0.00000	0.00001
7	Dimethyl Sulfide	$(CH_3)_2S + 9/2O_2 \longrightarrow SO_2 + 2CO_2 + 3H_2O$	0.1	0.00001	0.00089	0.00000	0.00000	0.00001
8	Ammonia	$NH_3 + 5/4O_2 \longrightarrow NO + 3/2H_2O$	37	0.00194	0.33045	0.00002	0.00192	0.00000
9	Trimethyl Amine	$(CH_3)_3N + 25/4O_2 \longrightarrow NO + 3CO_2 + 9/2H_2O$	2.3	0.00012	0.02054	0.00000	0.00012	0.00000
							0.00204	0.00006

Table 2 : Total Outlet Concentration of NOx and SOx

NO.	Component	Inlet Conc (ppm)	Inlet Conc (Kmol/h)	Comb Prod (Kmol/h)	Total Outlet (Kmol/h)	Outlet Conc (ppm)
1	NOx	8000	0.41947	0.00204	0.42151	7179.6
2	SOx	580	0.03041	0.00006	0.03047	519.1

ภาคผนวก ฐ สรุปการคำนวณออกแบบเตาเผาซ้ำของระบบ After Burning

ตาราง ฐ.1 ข้อมูลเบื้องต้นในการคำนวณออกแบบเตาเผาซ้ำ

	HAP Emission Stream Characteristic		Metric Unit		English Unit	
1	Maximum Flow Rate	Q_e	(Nm^3/h)	**1176.4**	(SCFM)	**731.9**
2	Density of Emission Gas	D_e	(Kg/Nm^3)	**1.2855**	(lb/SCF)	**0.0759**
3	Temperature of Emission Gas	T_e	(^oC)	**400**	(^oF)	**752**
4	Heat Content of Emission Gas	h_e	(KJ/Kg)	**436**	(Btu/lb)	**187.2**
5	Oxygen Content	O_2	(%)	**5.56**	(%)	**5.56**
6	Halogenated Organics		**No**			
7	Required Destruction Efficiency	DE	(%)	**99**	(%)	**99**
8.1	Type of Supplementary Fuel		**LPG (as Propane)**			
8.2	Density of Fuel	D_f	(Kg/Nm^3)	**1.12**	(lb/SCF)	**0.0662**
8.3	Heat Content of Fuel	h_f	(KJ/Kg)	**50295.2**	(Btu/lb)	**21600.0**
9	Existing Combustion Chamber Volume	V_e	(m^3)	**1**	(ft^3)	**35.3**

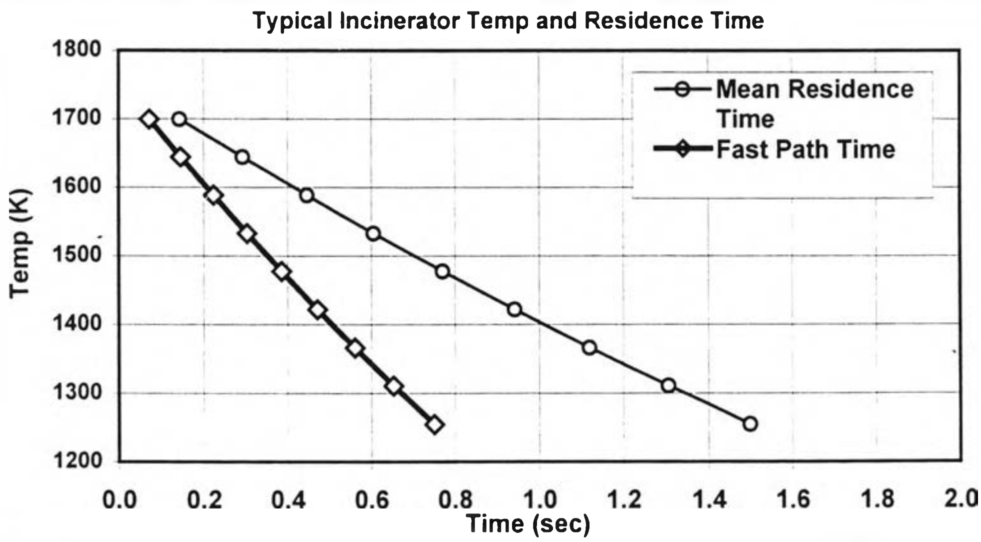
ตาราง ฐ.2 การคำนวณออกแบบขนาดเตาเผาซ้ำ

1	Required Destruction Efficiency	DE	(%)	**99**	(%)	**99**
2	Mean Residence Time	t_r	(sec)	**1.5**	(sec)	**1.5**
3	Fast Path Residence Time	t_f	(sec)	**0.75**	(sec)	**0.75**
4	Combustion Temperature	T_c	(^oC)	**982.2**	(^oF)	**1800**
5	Max. Temperature in Chamber	T_m	(^oC)	**1482.2**	(^oF)	**2700**
6	Exit Temperature	T_{ex}	(^oC)	**982.2**	(^oF)	**1800**
7	Estimated Heat Loss	HL	(%)	**3**	(%)	**3**
8	Supplementary Fuel Requirement	Q_f	(Nm^3/h)	**5.3**	(SCFM)	**3.3**
9	Combustion Air Requirement	Q_{fa}	(Nm^3/h)	**140.9**	(SCFM)	**87.7**
10	Combustion Gas Flow Rate	Q_{fc}	(Nm^3/h)	**146.3**	(SCFM)	**91.05**
11	Flue Gas Flow Rate	Q_{fg}	(Nm^3/h)	**1322.7**	(SCFM)	**823.0**
12	Combustion Chamber Volume	V_c	(m^3)	**3.40**	(ft^3)	**120.1**

Table 1 : Typical Temperature and Residence Time of Typical Incinerator

Vol of Chamber :	120.1	ft^3	3.4	m^3
Flow Rate :	823	SCFM	1323	Nm^3/h
Max. Temperature	2700	(^oF)	1755	K
Exit Temperature:	1800	(^oF)	1255	K

Temperature (K)	Temperature (oF)	Mean Residence Time (sec)	Fast Path Time (sec)
1700	2600	0.14	0.07
1644	2500	0.29	0.15
1589	2400	0.45	0.22
1533	2300	0.61	0.30
1477	2200	0.77	0.39
1422	2100	0.94	0.47
1366	2000	1.12	0.56
1311	1900	1.31	0.65
1255	1800	1.50	0.75



ภาคผนวก ฑ สรุปการคำนวณออกแบบไซโคลนของระบบ After Burning

ตาราง ฑ.1 สรุปพารามิเตอร์ในการคำนวณ

Use : Stairmand Standard Design

Parameter	Constant	Dimensions (mm)	
Q/D^2	16500	D	423
a/D	0.75	a	317
b/D	0.375	b	159
D_c/D	0.75	D_c	317
S/D	0.875	S	370
h/D	1.5	h	635
H/D	4	H	1693
B/D	0.375	B	159

ตาราง ฑ.2 การคำนวณความดันลดภายในไซโคลน

del P allowable not exceed 100 mmAq

Parameter	Value	
del H	7.2	
v_i	16.30	m/s
del P	482.8	Pa
	49.22	mmAq

ตาราง ฑ.3 การคำนวณประสิทธิภาพการกำจัดฝุ่นของไซโคลน

Parameter						
n_{283}	n_{673}	w/d^2	eff=1-exp(-2(Cwd²)^(1/(2n+2)))			
			d av (μm)			
			22	53.5	84	127
0.594	0.47350	7.356E+07	0.912742	0.98841	0.997653	0.99967

Part. Size (μm)	Mean Size (μm)	Fraction	Efficiency	Fraction*Efficiency	Dust Outlet Conc. (mg/m³)
0-44	22	0.8	0.912742	0.73019	12.85454
44-63	53.5	0.1	0.98841	0.09884	0.21342
63-105	84	0.05	0.997653	0.04988	0.02161
105-149	127	0.05	0.99967	0.04998	0.00304
Total		1		0.92890	13.0926

ภาคผนวก ฒ สรุปการคำนวณความดันสูญเสียของระบบ After Burner เพื่อกำหนดขนาดของพัดลม

ตาราง ผ.1 สรุปการคำนวณความดันสูญเสียของระบบ After Burner

Stream	Fitting No.	Fitting Source	Type of Fitting	Flow Rate (m^3/h)	Duct Size Equiv. (mm)	Velocity (m/s)	Velocity Press (Pa)	Length (m)	Fitting loss coefficient C_o	Duct Press drop /m (Pa)	Total Press drop (Pa)	Sectional drop (Pa)	Overall Press drop (Pa)	Overall Press drop (mmAq)
1,2	1	-	Duct	2954.5	304.8	11.25	31.95	10	-	2.365	23.654	95.549	1959.0	199.7
	2	6.6,6.2	Tee Tr	2954.5	-	11.25	31.95	-	0.55	-	17.574			
	3	7.4	Gate	2954.5	-	11.25	31.95	-	1.7	-	54.3206			
-		D-201		-	-	-	-	-	-	-	482.8	482.8		
3	1	-	Duct	2954.5	304.8	11.25	31.95	3.5	-	2.365	8.279	20.741		
	2	3.5	Elbow	2954.5	-	11.25	31.95	-	0.13	-	4.154			
	3	3.5	Elbow	2954.5	-	11.25	31.95	-	0.13	-	4.154			
	4	3.5	Elbow	2954.5	-	11.25	31.95	-	0.13	-	4.154			
-		Y-201		-	-	-	-	-	-	-	981	981		
6	1	-	Duct	6046.5	355.6	16.91	39.93	1.5	-	2.534	3.801	363.321		
	2	4.2	Diffuser	6046.5	-	16.91	39.93	-	0.58	-	23.161			
	3	-	Duct	56782.2	1270	12.45	87.62	5	-	1.557	7.783			
	4	7.4	Gate	56782.2	-	12.45	87.62	-	3.2	-	280.385			
	5	6.6,6.2	Tee Tr	56782.2	-	12.45	87.62	-	0.55	-	48.191			
8	1	-	Duct	63596.9	1270	13.95	1.79	10	-	1.557	15.567	15.567		

			REV.	DATE
Project	Emission Gas Treatment (After Burner Sysytem)		0	Mar.25'99
LINE	Stream 1	MADE		

STATIC REGAIN DUCT SIZING

DENSITY 0.505 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.0348898 cP = 3.49E-05 N.s/m^2

	PREVIOUS	THIS	
WIDTH		380	mm
HIGH		190	mm
DIAMETER	12"	304.8	mm
		0.3048	m
AREA		0.072966	m^2
FLOW		2954.5	m^3/hr
VELOCITY		11.24765	m/s
REYNOLDS		49621.46	
LENGTH		10	m
DROP/m@THIS SECTION		2.365361	Pa/m
TOTAL DROP		23.65361	Pa
		2.42	mmAq
STATIC PRESSURE REGAIN		-23.95775	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741867
2	0.016684	7.741867	6.560321
3	0.023235	6.560321	6.665379
4	0.022509	6.665379	6.655506
5	0.022576	6.655506	6.656429
6	0.022569	6.656429	6.656343
7	0.02257	6.656343	6.656351
8	0.02257	6.656351	6.656350
9	0.02257	6.656350	6.656350
10	**0.02257**	6.656350	6.656350

USE DUCT 380 x 190 mm

ตาราง ผ.3 การคำนวณความดันสูญเสียของสายการไหลที่ 3 ของระบบ After Burning

			REV.	DATE
Project	Emission Gas Treatment (After Burner Sysytem)		0	Mar.25'99
LINE	Stream 3	MADE		

STATIC REGAIN DUCT SIZING

DENSITY 0.505 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.0348898 cP = 3.49E-05 $N.s/m^2$

	PREVIOUS	THIS	
WIDTH		380	mm
HIGH		190	mm
DIAMETER	12"	304.8	mm
		0.3048	m
AREA		0.072966	m^2
FLOW		2954.5	m^3/hr
VELOCITY		11.24765	m/s
REYNOLDS		49621.46	
LENGTH		3.5	m
DROP/m@THIS SECTION		2.365361	Pa/m
TOTAL DROP		8.278765	Pa
		0.85	mmAq
STATIC PRESSURE REGAIN		-23.95775	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741867
2	0.016684	7.741867	6.560321
3	0.023235	6.560321	6.665379
4	0.022509	6.665379	6.655506
5	0.022576	6.655506	6.656429
6	0.022569	6.656429	6.656343
7	0.02257	6.656343	6.656351
8	0.02257	6.656351	6.656350
9	0.02257	6.656350	6.656350
10	**0.02257**	6.656350	6.656350

USE DUCT 380 x 190 mm

ตาราง ผ.4 การคำนวณความดันสูญเสียของสายการไหลที่ 6 ของระบบ After Burning

			REV.	DATE
Project	Emission Gas Treatment (After Burner Sysytem)		0	Mar.25'99
LINE	Stream 6	MADE		

STATIC REGAIN DUCT SIZING

DENSITY 0.27916 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.019 cP = 0.000019 $N.s/m^2$

	PREVIOUS	THIS	
WIDTH		450	mm
HIGH		225	mm
DIAMETER	14"	355.6	mm
		0.3556	m
AREA		0.099315	m^2
FLOW		6046.5	m^3/hr
VELOCITY		16.91174	m/s
REYNOLDS		88358.74	

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741867
2	0.016684	7.741867	6.560321
3	0.023235	6.560321	6.665379
4	0.022509	6.665379	6.655506
5	0.022576	6.655506	6.656429
6	0.022569	6.656429	6.656343
7	0.02257	6.656343	6.656351
8	0.02257	6.656351	6.656350
9	0.02257	6.656350	6.656350
10	**0.02257**	6.656350	6.656350

LENGTH	1.5	m
DROP/m@THIS SECTION	2.53376	Pa/m
TOTAL DROP	3.80064	Pa
	0.39	mmAq
STATIC PRESSURE REGAIN	-29.94062	Pa

USE DUCT 450 x 225 mm

ตาราง ผ.5 การคำนวณความดันสูญเสียของสายการไหลที่ 7 ของระบบ After Burning

			REV.	DATE
Project	Emission Gas Treatment (After Burner Sysytem)		0	Mar.25'99
LINE	Stream 7	MADE		

STATIC REGAIN DUCT SIZING

DENSITY 1.13 kg/m^3 ROUGHNESS 0.15 mm

VISC. 0.0183 cP = 1.83E-05 $N.s/m^2$

	PREVIOUS	THIS	
WIDTH		1600	mm
HIGH		800	mm
DIAMETER	50"	1270	mm
		1.27	m
AREA		1.266769	m^2
FLOW		56782.2	m^3/hr
VELOCITY		12.45123	m/s
REYNOLDS		976435.3	
LENGTH		5	m
DROP/m@THIS SECTION		1.556672	Pa/m
TOTAL DROP		7.783362	Pa
		0.79	mmAq
STATIC PRESSURE REGAIN		-65.69533	Pa

FRICTION OF THIS SECTION

ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741867
2	0.016684	7.741867	6.560321
3	0.023235	6.560321	6.665379
4	0.022509	6.665379	6.655506
5	0.022576	6.655506	6.656429
6	0.022569	6.656429	6.656343
7	0.02257	6.656343	6.656351
8	0.02257	6.656351	6.656350
9	0.02257	6.656350	6.656350
10	**0.02257**	6.656350	6.656350

USE DUCT **1600** x **800** mm

ตาราง ผม.6 การคำนวณความดันสูญเสียของสายการไหลที่ 8 ของระบบ After Burning

		REV.	DATE
Project	Emission Gas Treatment (After Burner Sysytem)	0	Mar.25'99
LINE	Stream 8 MADE		

STATIC REGAIN DUCT SIZING

DENSITY	1.037	kg/m^3		ROUGHNESS	0.15 mm
VISC.	0.0194	cP =	1.94E-05	$N.s/m^2$	

	PREVIOUS	THIS	
WIDTH		1600	mm
HIGH		800	mm
DIAMETER	50"	1270	mm
		1.27	m
AREA		1.266769	m^2
FLOW		63596.9	m^3/hr
VELOCITY		13.94557	m/s
REYNOLDS		946709.8	
LENGTH		10	m
DROP/m@THIS SECTION		1.792029	Pa/m
TOTAL DROP		17.92029	Pa
		1.83	mmAq
STATIC PRESSURE REGAIN		-75.62794	Pa

FRICTION OF THIS SECTION

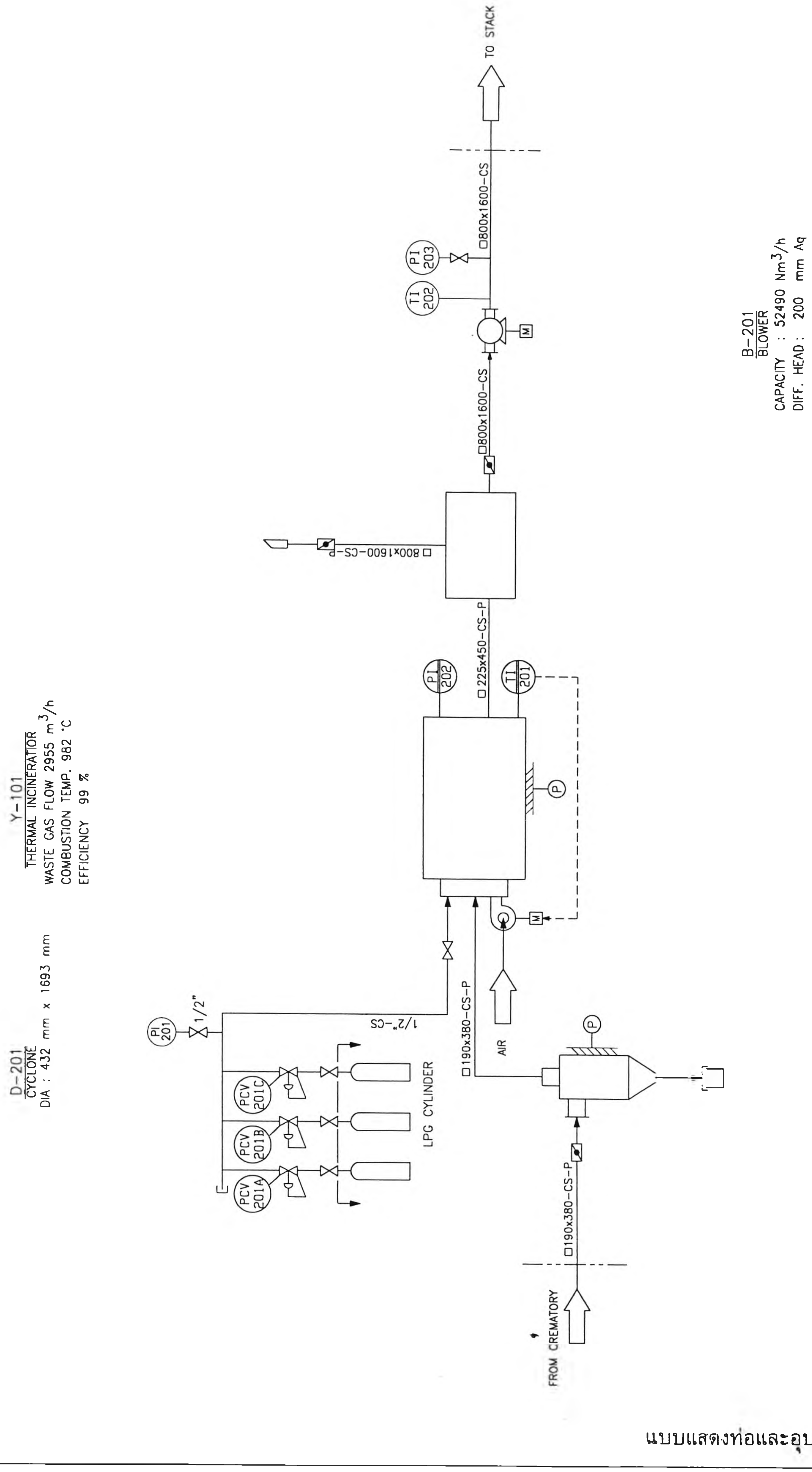
ITER.	f	LEFT	RIGHT
1	1000	0.031623	7.741867
2	0.016684	7.741867	6.560321
3	0.023235	6.560321	6.665379
4	0.022509	6.665379	6.655506
5	0.022576	6.655506	6.656429
6	0.022569	6.656429	6.656343
7	0.02257	6.656343	6.656351
8	0.02257	6.656351	6.656350
9	0.02257	6.656350	6.656350
10	**0.02257**	6.656350	6.656350

USE DUCT **1600** x **800** mm

ภาคผนวก ณ แบบต่างๆของระบบ After Burning

รายการของแบบในระบบได้แก่

หน้า



แบบแสดงท่อและอุปกรณ์วัดคุม

แบบแสดงรายการของอุปกรณ์ในระบบ.

Rev	Date	Made	hecke	Approved
0	Feb,09,199	N.A	N.A	

EQUIPMENT LIST

Plant: Emission Gas Treatment — Sheet 1 of 1

System: After Burner System

	ITEM NO.	NAME	NO. REQ'D		DESIGN CONDITION		OPERATING CONDITION		FLUID	TYPE	SPECIFICATIONS	MATERIAL	MOTOR	ELEC.	REMARKS
			W	S	PRESS. barG	TEMP. °C	PRESS. barA	TEMP. °C					kW	kW	
1	Y-201	Thermal Incinerator	1	-	-300 mmAq	>1000	-100 mmAq	982	Emission Gas	Thermal Oxidizer Gas w/o Heat Recovery	Emission Gas 2955 m^3/h Inlet Temp 400°C,Eff 99% + Residence Time 1.5 sec LPG consumption 10.4 kg/h	CS/ Refractory Brick			
2	D-201	Cyclone	1	-	-300 mmAq	450	-200 mmAq	400	Emission Gas	General	Press drop <100 mmAq Dia 632mm x 3669 mm	CS	-	-	
3	B-201	Blower	1	-	-300/100 mmAq	200	-200 mmAq	58	Treated Gas	Centrifugal	52490 Nm^3/h , 200 mmAq 200 mmAq 38 KW , 380 V , 3 Ph , 50 HZ	CS/CS	75	-	

	PLANT : EMISSION GAS TREATMENT
DESIGN DATA	ITEM NO. : D-201

DESIGN DATA

CODE	[ ] ASME/ANSI RTP-1 [ ] JIS B 824 [X] NONE	
DESIGN PRESS.	-0.05 bar / FW	
DESIGN TEMP.	450	°C
CORROSION ALLOWANCE	1.0	mm
HYDRO. TEST PRESS.	[ ] AS PER CODE [X] FW kg/cm²G	
PNEUM. TEST PRESS.	[ ] AS PER CODE [X] NONE kg/cm²G	
POST WELD HEAT TREATMENT	[ ] AS PER CODE [ ] YES [X] NONE	
RADIOGRAPHY	[ ] AS PER CODE [X] NO	
LONG JOINT EFFICIENCY	[ ] AS PER CODE [X] 0.7	
INSULATION	[ ] HOT [ ] COLD [X] P.P. (MM) [ ] NO	
WIND PRESSURE	None	
EARTHQUAKE FACTOR	None	

SERVICE NAME : CYCLONE

WEIGHT & CAPACITY

ERECTION WEIGHT	125	kg
OPERATING WEIGHT	125	kg
FULL WATER WEIGHT	1000	kg
CAPACITY	0.7	m³

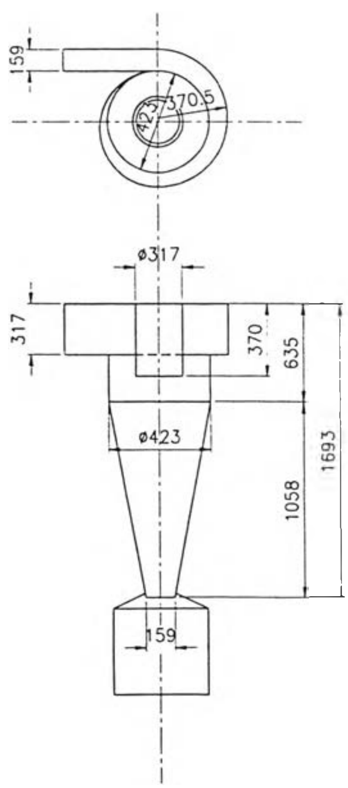
MATERIAL SPECIFICATIONS

SHELL & HEAD	CS
SUPPORTS	CS
INTERNALS	CS
NOZZLE NECKS	CS
FLANGES	CS
BOLTS & NUTS	CS
GASKETS	CAF

NOZZLE SCHEDULE

[X] ANSI B16.5
[ ]

MARK	NO. REQ'D	SIZE	RATING	TYPE	FACING	DESIGNATION
A	1	153X306	Cal		FF	GAS INLET
B	1	306	Cal		FF	GAS OUTLET
C	1	153	Cal		FF	DUST OUTLET



REV.	DWG	CHK	GL	SC	MGR	APPR	DATE	DESCRIPTION
2								
1								
0								FOR PROPOSAL

DWG. NO.

DATA SHEET FOR CENTRIFUGAL BLOWER

CUSTOMER			
LOCATION			
UNIT	Gas Treatment System		
SUPPLIER		JOB NO.	
ITEM NO.	B-201	REQ'N NO.	
SERVICE			
NO REQ'D	(WORKING 1 STAND-BY - TOTAL 1)		

REV	LINE	DATE	A/E	CHIEF	MGR.	PE.	PEM	PM.
0		Mar26'99	N.A					
1								
2								
3								
4								
5								

OPERATING CONDITIONS

GAS COMPOSITION	Treated Gas		CAPACITY	52490	Nm³/h DRY BASE
					m³/hr/ AT SUCTION
			TEMP. SUCTION	58	(°C)
SOLID AT SUCTION		(g/Nm³)	DISCHARGE	58	(°C)
R. H. AT SUCTION		(%)	PRESS. DISCHARGE (STATIC)	0	mmAqG
MOLECULAR WEIGHT	28.45		SUCTION RATED (STATIC)	-200	mmAqG
SPEC. WEIGHT AT SUCTION	1.037	(kg/m³)	DIFF. (STATIC)	200	mmAq
COMP. FACTOR (Z)			INSTALLATION	[ ] INDOOR	[X] OUTDOOR

CONSTRUCTIONS / MATERIALS

MFR. #	MODEL FY-33BCD-B	CODE	CASE	INTERNAL
TYPE [X] CENTRIF-BACKWARD	[ ] CENTRIF-RADIAL	CASE/HOUSING		
[ ] MULTI-BLADE	[ ] MIXED FLOW [ ] AXIAL	IMPELLER	SS41	
CASE : MOUNT [ ] BRACKET	[ ] FOOT [ ] C-LINE [ ] CAST	SHAFT	S35C	
: SPLIT [ ] AXIAL	[ ] RADIAL	SLEEVE		
: CONSTRUCTION	[X] FABRICATED [ ] CAST	GASKET		
DIA. VALUE		LABYRINTH		
NOZZLE / SIZE / RATING	FACING / POSITION	BASEPLATE	SSC41	
SUCTION / # / #	FF / END	[ ] LINING		
DISCH. / # / #	FF / TOP			

PERFORMANCE

WHEEL NO. [ ] OVHG	[ ] BET-BRG	SPEED (rpm)	EFF. (STATIC) (%)
TYPE [ ] CLOSED [ ] SEMI-OPEN	[ ] OPEN	BHP RATED	AT MIN. TEMP. (kW)
SUCTION [X] SINGLE [ ] DOUBLE		SUCTION [ ] NET	[ ] FILTER [ ] SILENCER
HUB FIT		MFR	TYPE
CONSTRUCTION [ ] FABRICATED	[ ] CAST	PD CLEAN	MAX. (mmAq)
DIA. (mm.)	CLEARANCE (mm.)	[ ] SUCTION DAMPER	[ ] DISCHARGE DAMPER
BLADE TYPE [ ] HOLLOW [ ] SOLID AIRFOIL		CONTROL [ ] MAN. [ ] AUTO.	
[ ] SINGLE-THICK. NO. OF BLADES		SIGNAL [ ] ELEC [ ] PNEUM	RANGE (%)
BEARING RADIAL	NO.	MAX. OPERATING RPESS.	(mmAqG)
TURUST	NO.	CASE DES. PRESS. (kg/cm²G	TEMP. (°C)
BEARING HOUSE CONSTRUCTION		[ ] CASE HYD. TEST PRESS.	(kg/cm²G)
LUBE [ ] OIL RING [ ] FLOOD	[ ] FLING [ ] PRESS	TYPE OF SEAL	
[ ] GREASE [ ] MIST-PURE	[ ] MIST-PURGE	[ ] MEACH. SEAL MFR	
POWER TRANS [ ] DIRECT [ ] GEAR	[ ] V-BELT [ ] SPD'VAR	MODEL	NO. OF SEAL
COUPLING [ ] FLEX [ ] RIGID	[ ] F-DISK [ ] SPACER	TYPE	API CODE
MFR	MODEL	MFR'S CADE	
ROTATION VIEWED FROM CPL'G END	[ ] CW [ ] CCW	MAT'L FACE	VS
BASEPLATE [X] COMMON	[ ] SOLE [ ] SEPARATE	METAL	GASKET
[ ] GROUTING REQUIREMENT		OTHER SEAL MFR	
NOZZLE ORIENTATION TYPE NO		MODEL	NO. OF RING
APPL. ENG. SPEC.		MATERIAL	
CODE/STANDARD			

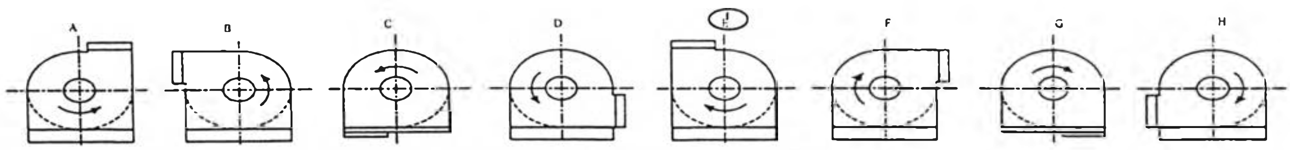
AUX.CONNECTIONS SERVICE	FLUID	INLET CONDITION (kg/cm²G)	(°C)	SP.GR	FLOW (m³/h)	MATERIAL (#1)	CONNECTIONS SIZE	RATING	FACE

TAPPED OPENING	[ ] DRAIN [ ] VALVE [ ] CAP [ ] PLUG [ ] FLANGE	(SIZE RATE FACE)
SPACE REQ'T (L*W*H) (m)	HAZARD. CLASS	
NOISE LEVEL (dBA@lm)	[ ] ACOUST ENCLOSURE SUPPLIED BY VENDOR	
WEIGHT (kg) BLOWER	BASE	MOTOR

MOTOR / TURBINE

SUPPLIED BY VENDOR	MOUNTED BY	VENDOR	SUPPLIED BY	MOUNTED BY	
MFR.	TYPE	TEFC	MFR.	TYPE	
RATED OUTPUT ### (kW)	POLE		RATED OU kW	(kW) SPEED	(rpm)
SPEED		(rpm)	INLET STEAM	(kg/cm²G)	(°C)
PHASE 3 CYCLE	50	VOLTS 380	EXHAUST	(kg/cm²G)	
INSULATION CLASS	IP		BRG	LUBE	
HAZARDOUS AREA CLASS	-		STEAM RATE	(kg)	AT RATED

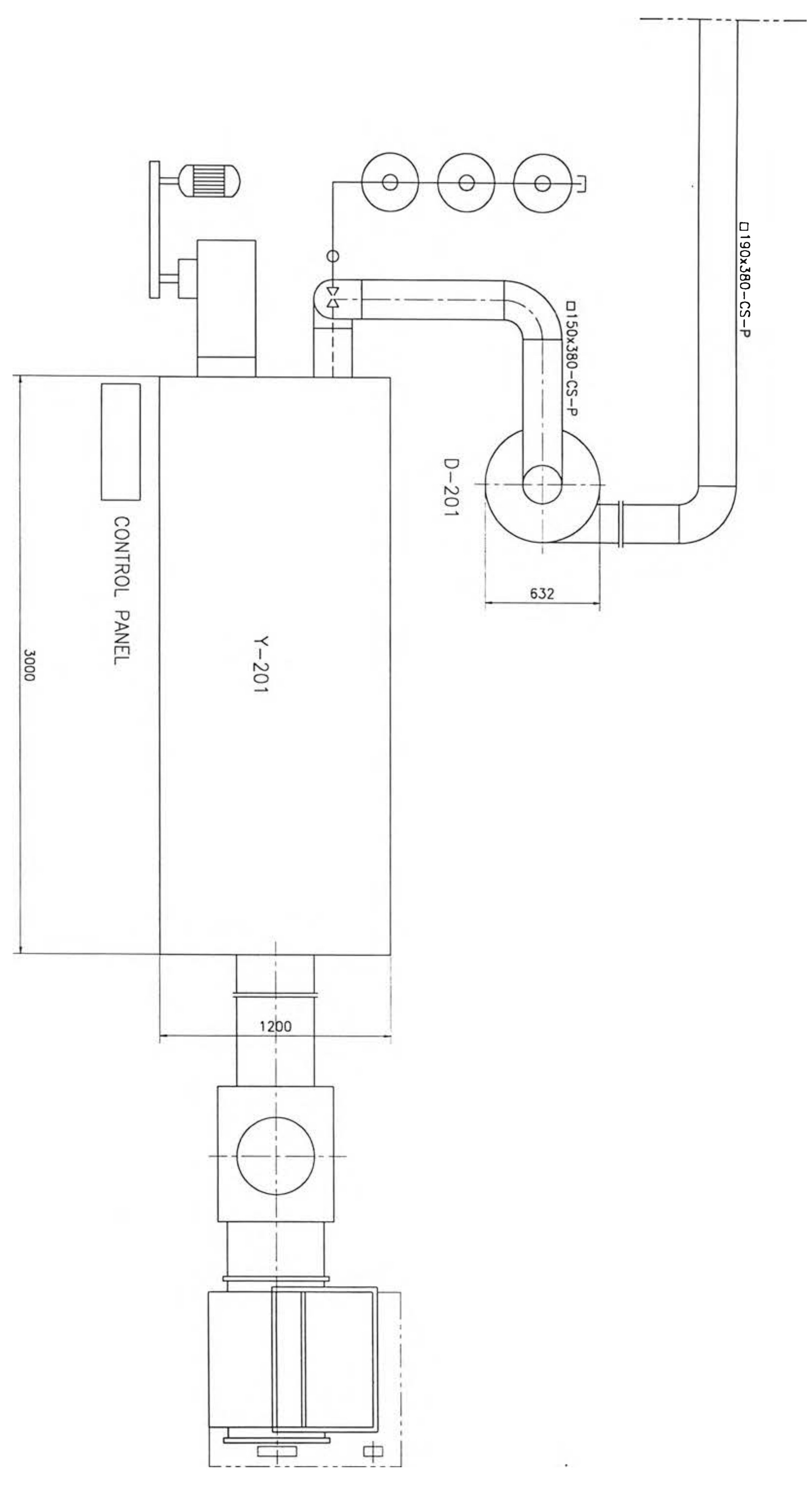
NOZZLE ORIENTATION VIEWED FROM CPL'G END

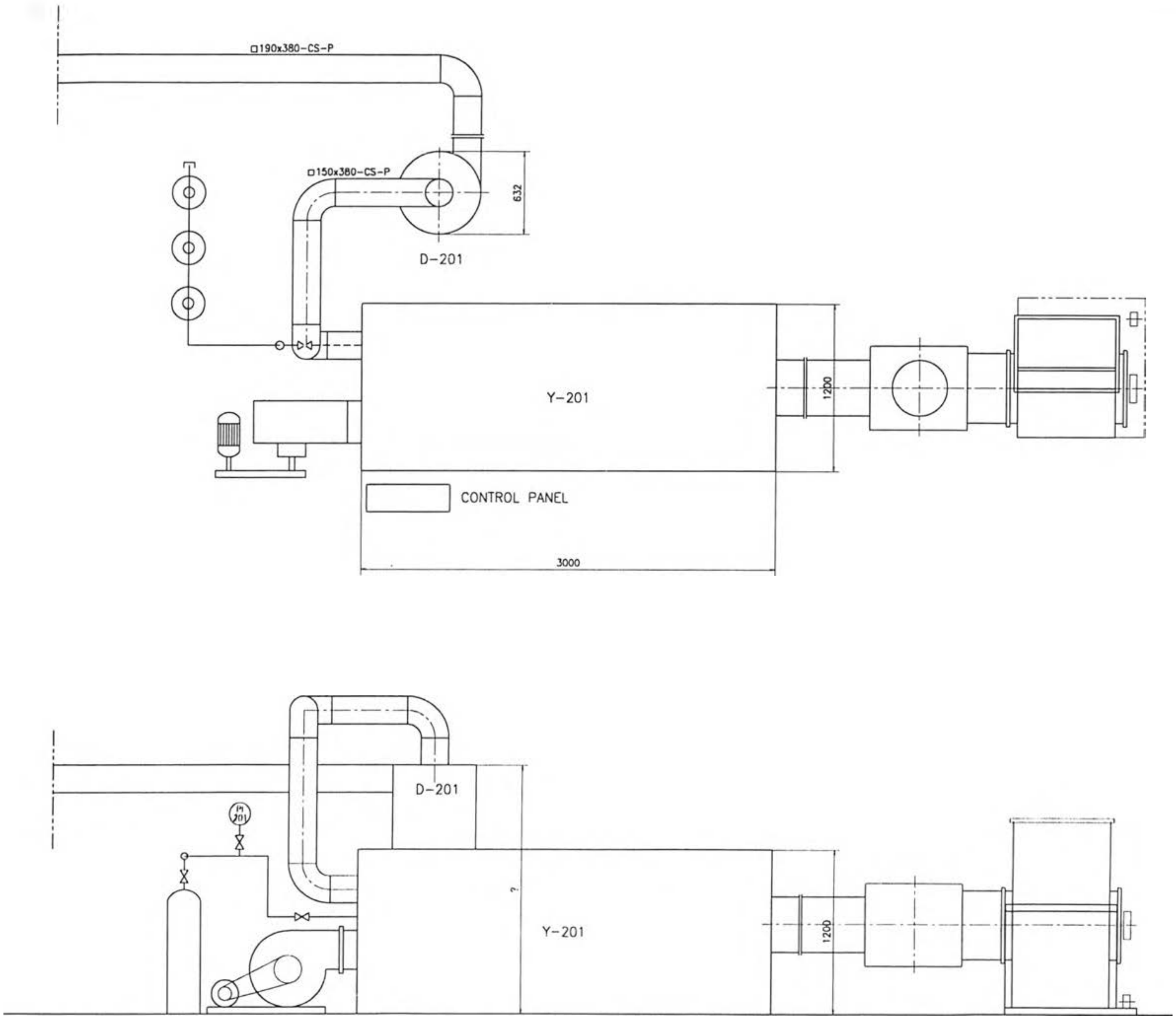


REMARKS

แบบแสดงข้อมูลของพัดลม.

แบบแสดงผังตำแหน่งของอุปกรณ์.





□190x380-CS-P
□150x380-CS-P
632
D-201
Y-201
1200
CONTROL PANEL
3000
D-201
201
Y-201
1200

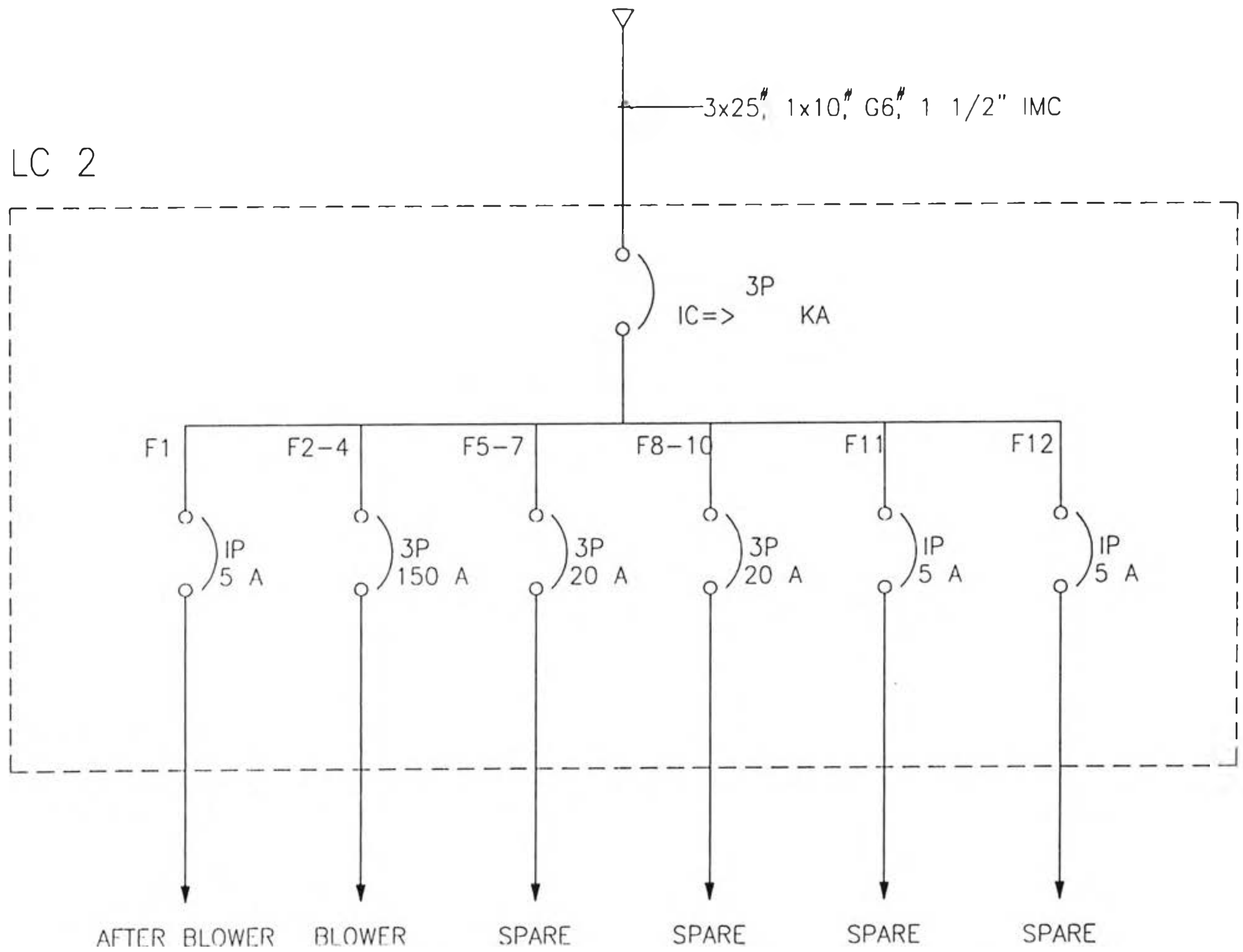
Rev	Date	Made	Checke	Aprr
0	04/06/99	N.A	N.A	

ELECTRICAL CONSUMPTION LIST

Plant: Emission Gas Treatment
System: After Burner System

NO.	ITEM NO.	NAME	NO. REQ'D W	NO. REQ'D S	Capacity (KW)	Phase	Voltage (V)	Frequency (Hz)	Motor Type	Start Method	Speed (rpm)	REMARKS
1	B-201	Blower	1	-	75	3	380	50	Vertical TEFC,Outdoor	Direct on-line	1450	
2	Y-201	After Burner	1	-	0.2	1	220	50	Horizontal TEFC,Outdoor	Direct on-line	2900	

แบบแสดงรายการใช้ไฟฟ้าของอุปกรณ์ในระบบ.



แบบแสดงผังไฟฟ้าสายเดียว.

แบบแสดงอุปกรณ์วัดคุมความดัน.

INSTRUMENT DATA SHEET (PRESSURE)

System : After Burner
Sheet No. : 1/1
Rev : 0
Rev Date : Apr.06, 1999
Made By : N.A

1	STREAM No.	4	-	8	4
2	TAG No.	PI 201	PI 202	PI 203	PCV 201 A~C
3	QUANTITY	1	1	1	3
4	SERVICE	LPG Line	Y-201	Air to Stack	LPG Tanks
5	FLUID	LPG	Combustion Gas	Treated Gas	LPG
6	PHASE	Gas	Gas	Gas	Gas
7	DESIGN TEMPERATURE,	60	1000	150	60
8	OPER. TEMPERATURE, °	30	981	57.8	30
9	DESIGN PRESSURE, BAR	1	50 mmAq	200 mmAq	35
10	MAX. PRESSURE, BAR A	-	0 mmAq	50 mmAq	33.5
11	NOR. PRESSURE, BAR A	1.5	-150 mmAq	25 mmAq	14.5
12	MIN. PRESSURE, BAR A	-	-	0 mmAq	
13	ALARM ACTION	-	-	-	
14	ALARM SET POINT,BAR A	-	-	-	
15	METER RANGE, BAR G	0 ~ 6	-200 ~50 mmAq	-200 ~200 mmAq	
16	SPECIAL INSTRUMENT TY	Bourdon	Compound	Barometer	Regulator
17	SPECIAL MATERIAL	-	-	-	-
18	LINE SIZE, INCH	1/2	1/2	1/2	1/2
19	LINE CLASS	CS	-	CS	CS
20	REMARKS	-	Local Panel Mounted with Package unit	-	Differntial Pressure
21	P & ID No.	2	2	2	2

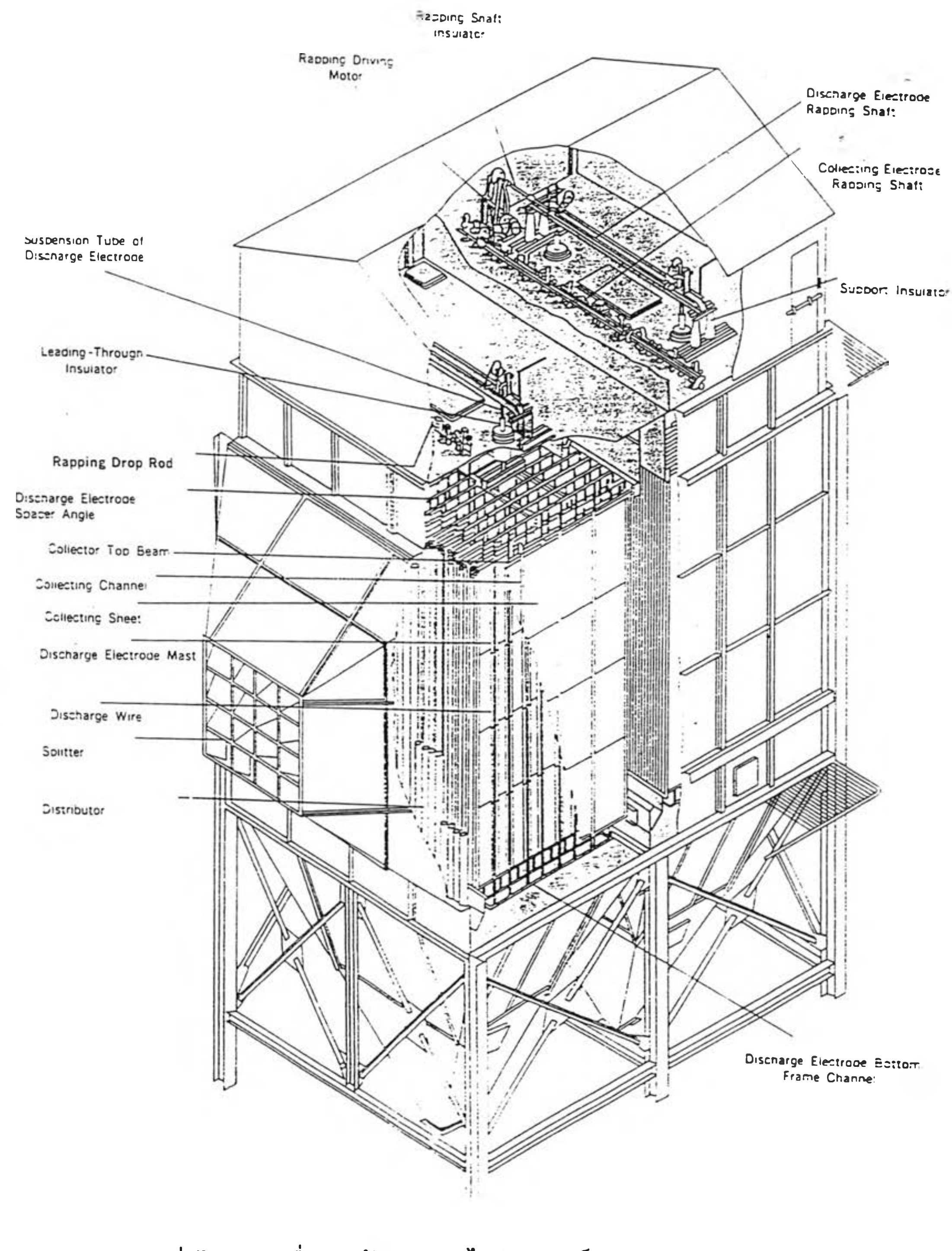
แบบแสดงอุปกรณ์วัดคุมอุณหภูมิ.

INSTRUMENT DATA SHEET (TEMPERATURE)

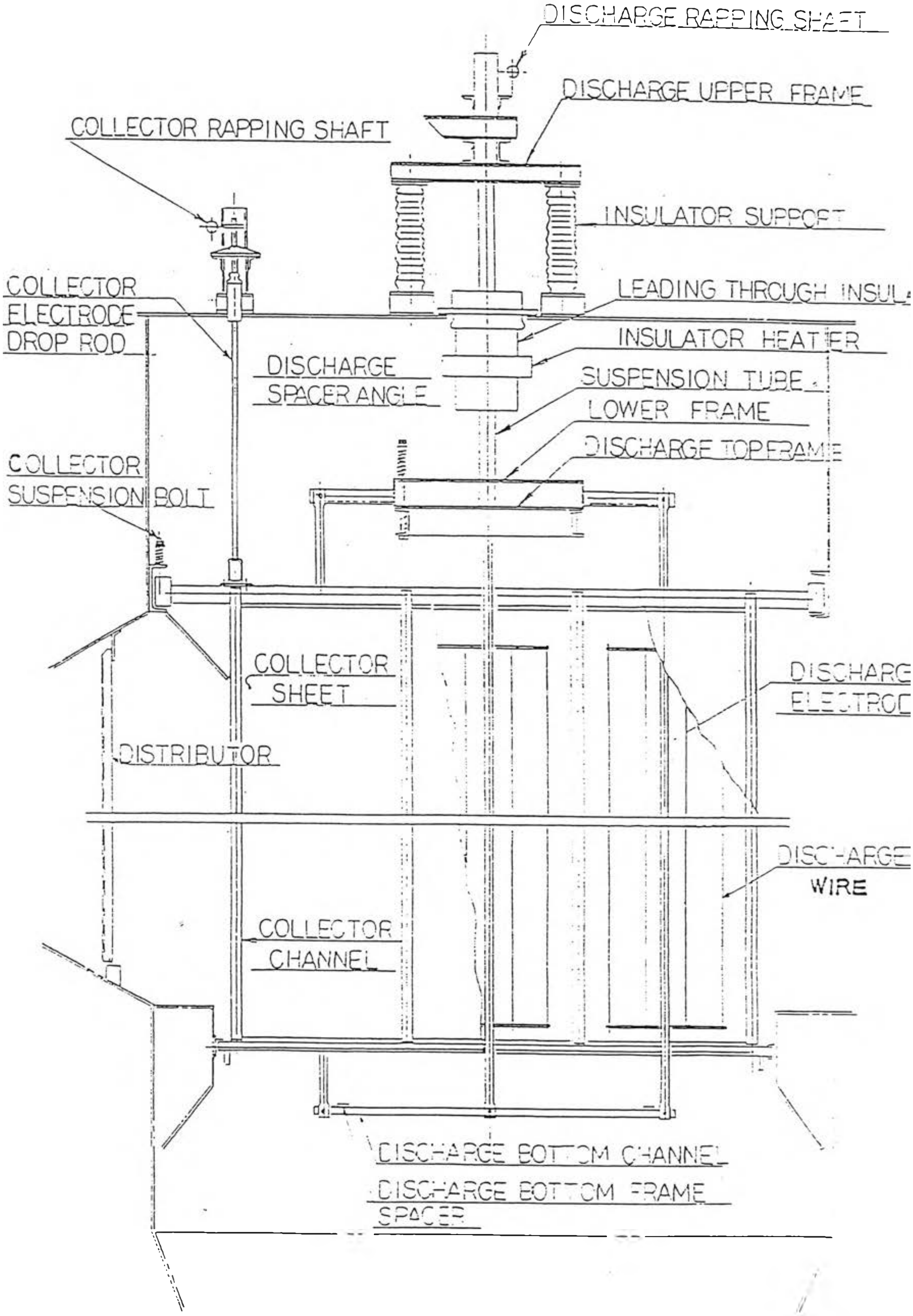
System : After Burner
Sheet No. : 1/1
Rev : 0
Rev Date : Apr.06, 1999
Made By : N.A

1	STREAM No.	-	8		
2	TAG No.	TI 201	TI 202		
3	QUANTITY	1	1		
4	SERVICE	Y-201	B-201 Outlet		
5	PHASE	Gas	Gas		
6	DESIGN TEMPERATURE, °	1000	400		
7	DESIGN PRESSURE, BAR	-200 mmAq	100 mmAq		
8	OPER. PRESSURE, BAR A	-100 mmAq	25 mmAq		
15	MAX. TEMP., °C	1000	400		
16	NOR. TEMP., °C	982	58.7		
17	MIN. TEMP., °C	-	-		
18	ALARM ACTION	H	-		
19	ALARM SET POINT, °C	1000	-		
20	METER RANGE, °C	0~1200	0~400		
21	SPECIAL INSTRUMENT TY	Thermocouple	Bi-Metal		
22	SPECIAL MATERIAL	-	-		
23	LINE SIZE, INCH	3/4	3/4		
24	LINE CLASS	-	-		
25	REMARKS	Local Panel	-		
		Mounted with			
		Package unit			
26	P & ID No.	2	2		

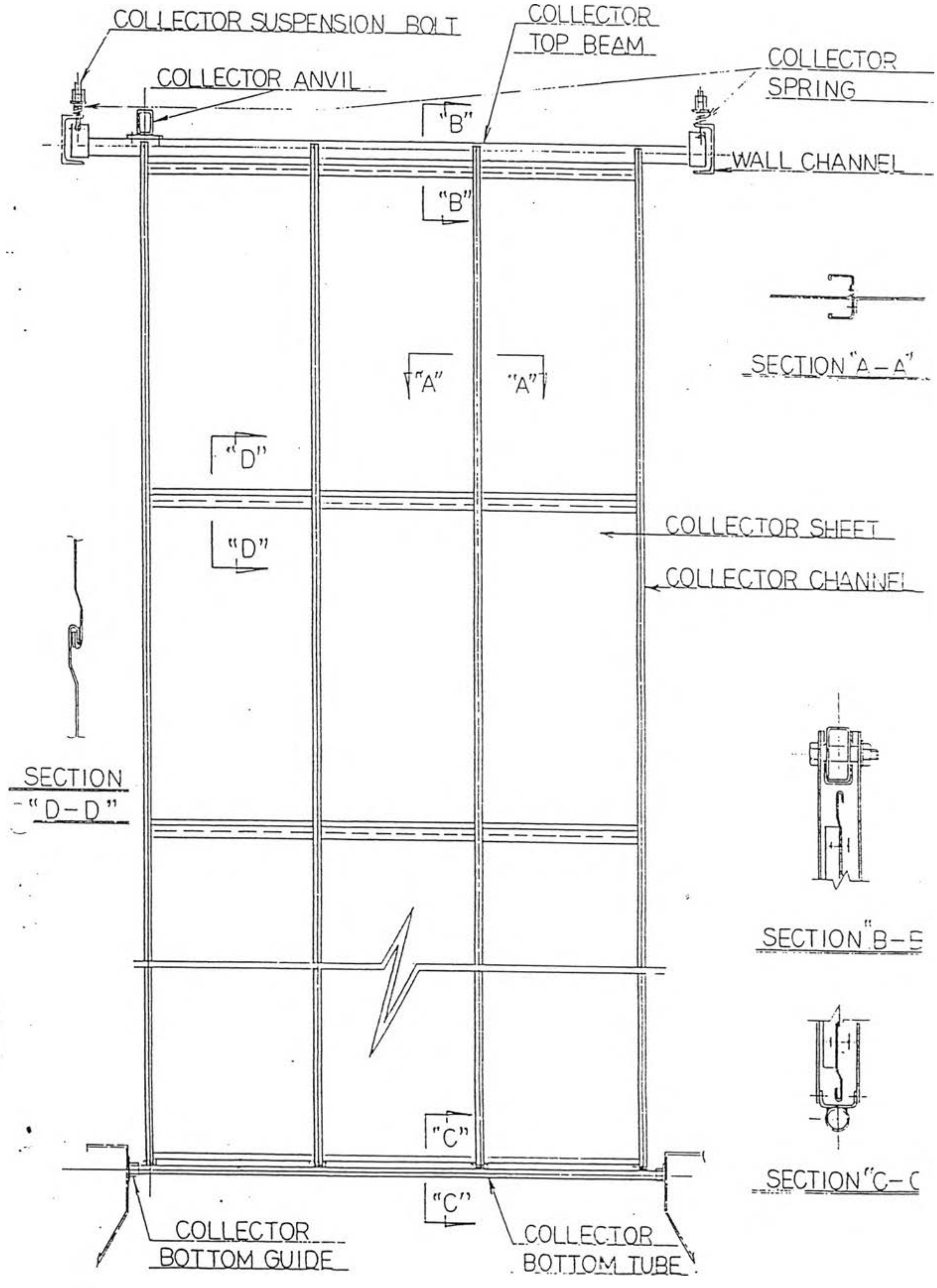
ภาคผนวก ด รูปร่างลักษณะและแบบแสดงการจัดเรียงภายในของเครื่องกำจัดฝุ่นแบบไฟฟ้าสถิตย์ (32)



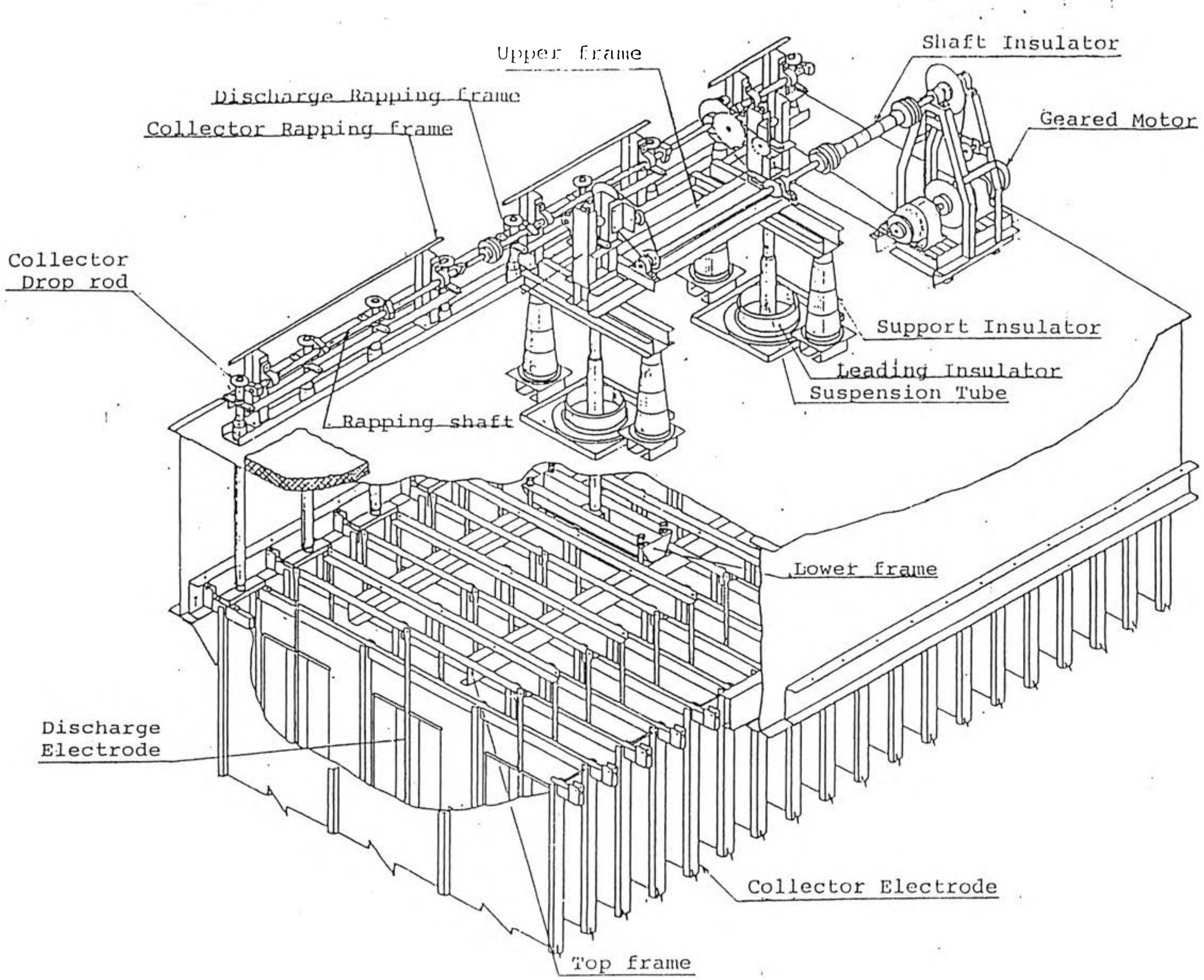
รูป ด.1 รูปร่างลักษณะทั่วไปของเครื่องกำจัดฝุ่นแบบไฟฟ้าสถิตย์.



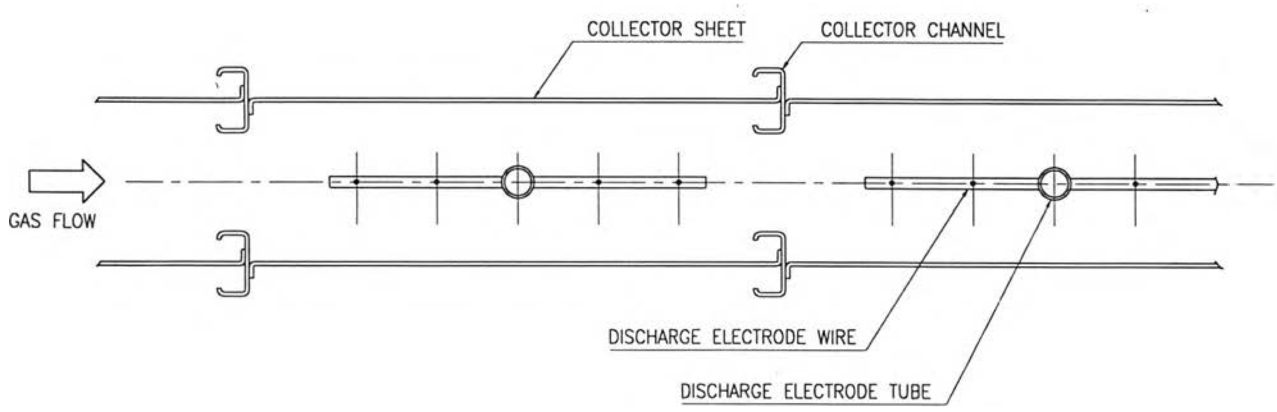
รูปด.2 รูปร่างลักษณะภายในของเครื่องกำจัดฝุ่นแบบไฟฟ้าสถิตย์.



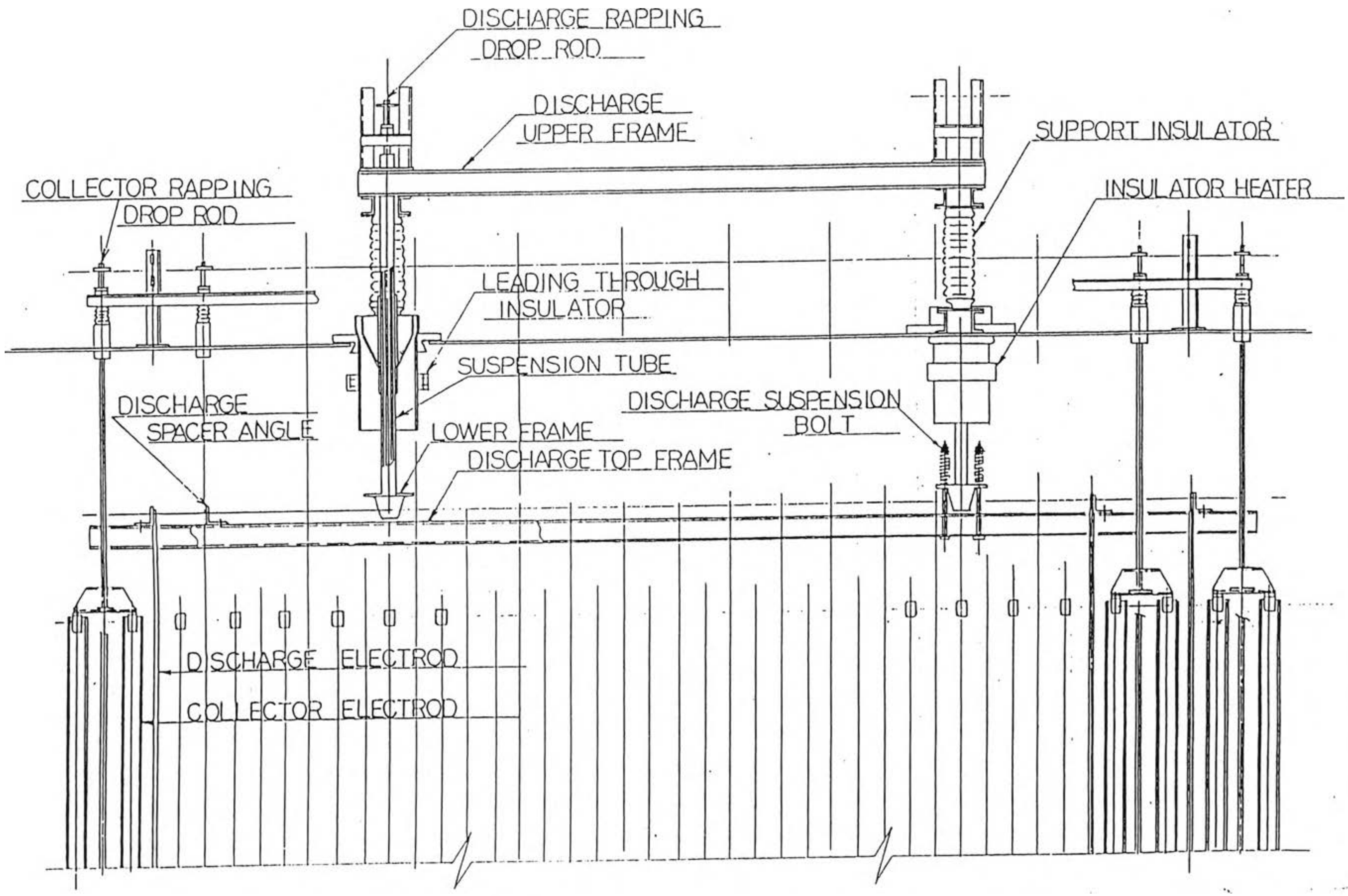
รูปด.3 แสดงการจัดวางขั้วคาโธด.



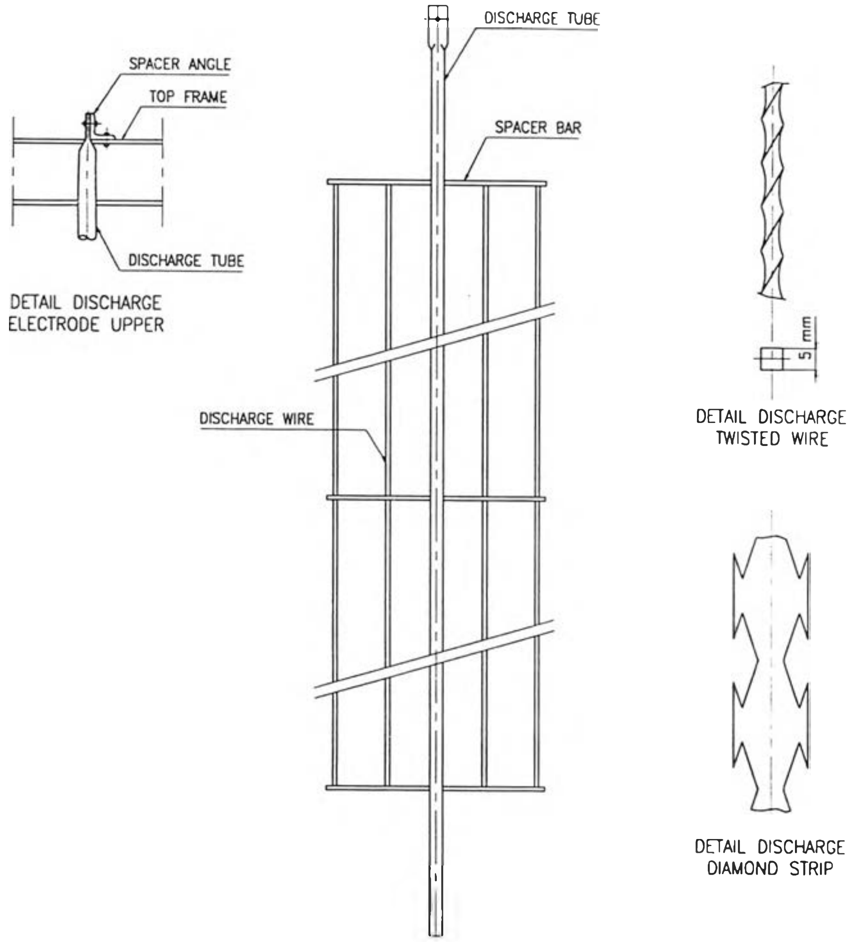
รูปด.4 แสดงการจัดวางของเครื่องกำเนิดไฟฟ้าสถิตย์.



รูปด.6 แสดงการไหลของก๊าซผ่านเครื่องกำจัดฝุ่นแบบไฟฟ้าสถิตย์.



รูปด.5 แสดงการจัดวางภายในเครื่องกำเนิดไฟฟ้าสถิตย์.



รูป ค.7 แสดง Support ของขั้วคาโธดภายใน

ประวัติผู้เขียน

นายนพดล อนุจารีอาภา เกิดวันที่ 19 พฤศจิกายน พ.ศ. 2513 ที่จังหวัดกรุงเทพมหานคร สำเร็จการศึกษาปริญญาตรีวิศวกรรมศาสตรบัณฑิต ภาควิชาวิศวกรรมเคมี คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี (สถาบันเทคโนโลยีพระจอมเกล้าธนบุรี) ในปีการศึกษา 2535 และเข้าศึกษาต่อในหลักสูตรวิศวกรรมศาสตรมหาบัณฑิต ภาควิชาวิศวกรรมเคมี คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย เมื่อ พ.ศ. 2537