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LAMPIRAN

Lampiran 1

Tabel Data Penelitian Efisiensi Boiler

PARAMETER	DATA		
Q produksi uap (bar)	7,2	7	7,1
q laju konsumsi bahan bakar (kg/H)	73,2	94,4	95,5
GCV B30 (kkal/h)	10702	10702	10702
Carbon **C** (Wt%)	81,8	81,8	81,8
Oxygen **O Fuel** (Wt%)	5,68	5,68	5,68
Sulfur **S** (Wt%)	0,073	0,073	0,073
Hydrogen **H2** (Wt%)	12,4	12,4	12,4
Nitrogen **N2**	0	0	0
Oxygen Precentage flue **O2** (%)	10,4	10,4	10,4
Temperatur gas buang **Tf**	171,7	170,7	171,4
Temperatur ruangan **Ta**	31	32,1	31,3
Kelembaban (kg/cm3)	0,022	0,021	0,021
Kalor Spesifik Gas Buang (kcal/Kg℃)	0,23	0,23	0,23
Kalor Spesifik Steam (kcal/Kg℃)	0,45	0,45	0,45

Tabel Data Penelitian *Head Loss* Pada Pipa Distribusi Uap

PARAMETER	BOILER TO HEADER			HEADER TO HEADER		
Tekanan (kPa)	700	710	720	568,786	578,592	588,399
Density (ρ)	3,665957915	3,712917239	3,761236695	3,007971123	3,056608387	3,106844378
Kecepatan (m/s)	3,79	3,85	3,91	2,5	2,57	2,64
Temperature (°c)	140,7	141,4	141,7	136,7	137,2	137,4
Volume Spesifik (m^3/kg)	0,27278	0,26933	0,26587	0,33245	0,32716	0,32187
konstanta uap (J/Kg.K)	461,5	461,5	461,5	461,5	461,5	461,5
Viskositas Dinamik (N/m^2)	1,357*10^-5	1,359*10^-5	1,361*10^-5	1,344*10^-5	1,345*10^-5	1,346*10^-5
Kekasaran Permukaan (m)	0,00026	0,00026	0,00026	0,00026	0,00026	0,00026
Diameter pipa (m)	0,1016	0,1016	0,1016	0,127	0,127	0,127
panjang pipa (m)	7	7	7	138,5	138,5	138,5

Lampiran 2

Tabel Hasil Perhitungan Efisiensi Boiler

Tekanan Uap	Udara Teoritis (Kg/Kg bahan bakar)	Excess Air (%)	Actual Air Supplied (Kg/Kg bahan bakar)	Massa Dry Flue Gas (Kg/Kg bahan bakar)	L1 (%)	L2 (%)	L3 (%)	L4 (%)	Efisiensi Boiler (%)
700	13,40	98,11	26,55	26,83	7,70	6,74	0,32	1,50	83,74
710	13,40	98,11	26,55	25,83	7,78	6,75	0,33	1,50	83,65
720	13,40	98,11	26,55	25,83	7,81	6,75	0,35	1,50	83,59

Tabel Hasil Perhitungan *head loss* Terhadap Gesekan Pada Pipa Distribusi Uap

LOKASI PIPA UAP	Tekanan Uap (kPa)	Bilangan Reynolds (Re)	Faktor Gesek (f)	Head Loss Terhadap Gesekan (m)
BOILER TO HEADER	700	104025,68	0,026330962	1,33
	710	106868,63	0,026299648	1,37
	720	109785,00	0,026269124	1,41
HEADER TO HEADER	568,8	71058,84	0,025646968	8,91
	578,6	74174,45	0,025569551	9,39
	588,4	77389,51	0,025495653	9,88

Tabel Hasil Perhitungan *Head loss* Terhadap *Fitting* Pada Pipa Distribusi Uap

a. *Head loss* Terhadap *Fitting* Pada Pipa Distribusi Uap Dari *Boiler* Cochran Ke *Header* A

Tekanan Uap (kPa)	Fitting Pipa	Jumlah	Koefisien	Head Loss Terhadap Fitting (m)
700 kPa	gate valve	4	0,15	0,44
710 kPa		4		0,45
720 kPa		4		0,47
700 kPa	elbow 90°	2	0,3	0,44
710 kPa		2		0,45
720 kPa		2		0,47
700 kPa	separator	1	0,35	0,26
710 kPa		1		0,26
720 kPa		1		0,27

b. *Head loss* Terhadap *Fitting* Pada Pipa Distribusi Uap Dari *Header* A ke *Header* B

Tekanan Uap (kPa)	Fitting Pipa	Jumlah	Koefisien	Head Loss Terhadap Fitting (m)
568,8	gate valve	2	0,15	0,10
578,6		2		0,10
588,4		2		0,11
568,8	elbow 90°	8	0,3	0,51
578,6		8		0,54
588,4		8		0,57
568,8	Elbow 45°	2	0,2	0,13
578,6		2		0,13
588,4		2		0,14
568,8	ekpansion joint	3	0,85	0,81
578,6		3		0,86
588,4		3		0,91

Tekanan Uap (kPa)	Head loss Terhadap Fitting (m)
700	1,13
710	1,17
720	1,21
568,8	1,54
578,6	1,63
588,4	1,72

Lampiran 3

Dokumentasi Pengambilan Data