ภาคผนวก

ภาคผนวก ก.

ตารางที่ ก.1 — ก.12 Selected thermodynamic properties of gases comprising C-H-O-N system

ตารางที่ ก.13 Fuel Properties

ตารางที่ ก.14 Select properties of Air, Nitrogen, and Oxygen

ตาราง ก.1 Carbon dioxide (CO_2), MW = 44.011, enthalpy of formation @ 298 K (kJ/kmol) = −393,546

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^o(T) - \bar{h}^o_f(298))$ (kJ/kmol)	$\bar{h}^o_f(T)$ (kJ/kmol)	$\bar{s}^o(T)$ (kJ/kmol-K)	$\bar{g}^o_f(T)$ (kJ/kmol)
200	32.387	−3,423	−393,483	199.876	−394,126
298	37.198	0	−393,546	213.736	−394,428
300	37.280	69	−393,547	213.966	−394,433
400	41.276	4,003	−393,617	225.257	−394,718
500	44.569	8,301	−393,712	234.833	−394,983
600	47.313	12,899	−393,844	243.209	−395,226
700	49.617	17,749	−394,013	250.680	−395,443
800	51.550	22,810	−394,213	257.436	−395,635
900	53.136	28,047	−394,433	263.603	−395,799
1,000	54.360	33,425	−394,659	269.268	−395,939
1,100	55.333	38,911	−394,875	274.495	−396,056
1,200	56.205	44,488	−395,083	279.348	−396,155
1,300	56.984	50,149	−395,287	283.878	−396,236
1,400	57.677	55,882	−395,488	288.127	−396,301
1,500	58.292	61,681	−395,691	292.128	−396,352
1,600	58.836	67,538	−395,897	295.908	−396,389
1,700	59.316	73,446	−396,110	299.489	−396,414
1,800	59.738	79,399	−396,332	302.892	−396,425
1,900	60.108	85,392	−396,564	306.132	−396,424
2,000	60.433	91,420	−396,808	309.223	−396,410
2,100	60.717	97,477	−397,065	312.179	−396,384
2,200	60.966	103,562	−397,338	315.009	−396,346
2,300	61.185	109,670	−397,626	317.724	−396,294
2,400	61.378	115,798	−397,931	320.333	−396,230
2,500	61.548	121,944	−398,253	322.842	−396,152
2,600	61.701	128,107	−398,594	325.259	−396,061
2,700	61.839	134,284	−398,952	327.590	−395,957
2,800	61.965	140,474	−399,329	329.841	−395,840
2,900	62.083	146,677	−399,725	332.018	−395,708
3,000	62.194	152,891	−400,140	334.124	−395,562
3,100	62.301	159,116	−400,573	336.165	−395,403
3,200	62.406	165,351	−401,025	338.145	−395,229
3,300	62.510	171,597	−401,495	340.067	−395,041
3,400	62.614	177,853	−401,983	341.935	−394,838
3,500	62.718	184,120	−402,489	343.751	−394,620
3,600	62.825	190,397	−403,013	345.519	−394,388
3,700	62.932	196,685	−403,553	347.242	−394,141
3,800	63.041	202,983	−404,110	348.922	−393,879
3,900	63.151	209,293	−404,684	350.561	−393,602
4,000	63.261	215,613	−405,273	353.161	−393,311
4,100	63.369	221,945	−405,878	353.725	−393,004
4,200	63.474	228,287	−406,499	355.253	−392,683
4,300	63.575	234,640	−407,135	356.748	−392,346
4,400	63.669	241,002	−407,785	358.210	−391,995
4,500	63.753	247,373	−408,451	359.642	−391,629
4,600	63.825	253,752	−409,132	361.044	−391,247
4,700	63.881	260,138	−409,828	362.417	−390,851

ตาราง ก.2 Hydrogen (H_2), MW = 2.016, enthalpy of formation @ 298 K (kJ/kmol) = (

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^o(T) - \bar{h}^o_f(298))$ (kJ/kmol)	$\bar{h}^o_f(T)$ (kJ/kmol)	$\bar{s}^o(T)$ (kJ/kmol-K)	$\bar{g}^o_f(T)$ (kJ/kmo
200	28.522	−2,818	0	119.137	0
298	28.871	0	0	130.595	0
300	28.877	53	0	130.773	0
400	29.120	2,954	0	139.116	0
500	29.275	5,874	0	145.632	0
600	29.375	8,807	0	150.979	0
700	29.461	11,749	0	155.514	0
800	29.581	14,701	0	159.455	0
900	29.792	17,668	0	162.950	0
1,000	30.160	20,664	0	166.106	0
1,100	30.625	23,704	0	169.003	0
1,200	31.077	26,789	0	171.687	0
1,300	31.516	29,919	0	174.193	0
1,400	31.943	33,092	0	176.543	0
1,500	32.356	36,307	0	178.761	0
1,600	32.758	39,562	0	180.862	0
1,700	33.146	42,858	0	182.860	0
1,800	33.522	46,191	0	184.765	0
1,900	33.885	49,562	0	186.587	0
2,000	34.236	52,968	0	188.334	0
2,100	34.575	56,408	0	190.013	0
2,200	34.901	59,882	0	191.629	0
2,300	35.216	63,388	0	193.187	0
2,400	35.519	66,925	0	194.692	0
2,500	35.811	70,492	0	196.148	0
2,600	36.091	74,087	0	197.558	0
2,700	36.361	77,710	0	198.926	0
2,800	36.621	81,359	0	200.253	0
2,900	36.871	85,033	0	201.542	0
3,000	37.112	88,733	0	202.796	0
3,100	37.343	92,455	0	204.017	0
3,200	37.566	96,201	0	205.206	0
3,300	37.781	99,968	0	206.365	0
3,400	37.989	103,757	0	207.496	0
3,500	38.190	107,566	0	208.600	0
3,600	38.385	111,395	0	209.679	0
3,700	38.574	115,243	0	210.733	0
3,800	38.759	119,109	0	211.764	0
3,900	38.939	122,994	0	212.774	0
4,000	39.116	126,897	0	213.762	0
4,100	39.291	130,817	0	214.730	0
4,200	39.464	134,755	0	215.679	0
4,300	39.636	138,710	0	216.609	0
4,400	39.808	142,682	0	217.522	0
4,500	39.981	146,672	0	218.419	0
4,600	40.156	150,679	0	219.300	0
4,700	40.334	154,703	0	220.165	0

ตาราง ก.3 Carbon monoxide (CO), MW = 28.010, enthalpy of formation @ 298 K (kJ/kmol) = −110,541

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^\circ(T) - \bar{h}^\circ_f(298))$ (kJ/kmol)	$\bar{h}^\circ_f(T)$ (kJ/kmol)	$\bar{s}^\circ(T)$ (kJ/kmol-K)	$\bar{g}^\circ_f(T)$ (kJ/kmol)
200	28.687	−2,835	−111,308	186.018	−128,532
298	29.072	0	−110,541	197.548	−137,163
300	29.078	54	−110,530	197.728	−137,328
400	29.433	2,979	−110,121	206.141	−146,332
500	29.857	5,943	−110,017	212.752	−155,403
600	30.407	8,955	−110,156	218.242	−164,470
700	31.089	12,029	−110,477	222.979	−173,499
800	31.860	15,176	−110,924	227.180	−182,473
900	32.629	18,401	−111,450	230.978	−191,386
1,000	33.255	21,697	−112,022	234.450	−200,238
1,100	33.725	25,046	−112,619	237.642	−209,030
1,200	34.148	28,440	−113,240	240.595	−217,768
1,300	34.530	31,874	−113,883	243.344	−226,453
1,400	34.872	35,345	−114,543	245.915	−235,087
1,500	35.178	38,847	−115,225	248.332	−243,674
1,600	35.451	42,379	−115,925	250.611	−252,214
1,700	35.694	45,937	−116,644	252.768	−260,711
1,800	35.910	49,517	−117,380	254.814	−269,164
1,900	36.101	53,118	−118,132	256.761	−277,576
2,000	36.271	56,737	−118,902	258.617	−285,948
2,100	36.421	60,371	−119,687	260.391	−294,281
2,200	36.553	64,020	−120,488	262.088	−302,576
2,300	36.670	67,682	−121,305	263.715	−310,835
2,400	36.774	71,354	−122,137	265.278	−319,057
2,500	36.867	75,036	−122,984	266.781	−327,245
2,600	36.950	78,727	−123,847	268.229	−335,399
2,700	37.025	82,426	−124,724	269.625	−343,519
2,800	37.093	86,132	−125,616	270.973	−351,606
2,900	37.155	89,844	−126,523	272.275	−359,661
3,000	37.213	93,562	−127,446	273.536	−367,684
3,100	37.268	97,287	−128,383	274.757	−375,677
3,200	37.321	101,016	−129,335	275.941	−383,639
3,300	37.372	104,751	−130,303	277.090	−391,571
3,400	37.422	108,490	−131,285	278.207	−399,474
3,500	37.471	112,235	−132,283	279.292	−407,347
3,600	37.521	115,985	−133,295	280.349	−415,192
3,700	37.570	119,739	−134,323	281.377	−423,008
3,800	37.619	123,499	−135,366	282.380	−430,796
3,900	37.667	127,263	−136,424	283.358	−438,557
4,000	37.716	131,032	−137,497	284.312	−446,291
4,100	37.764	134,806	−138,585	285.244	−453,997
4,200	37.810	138,585	−139,687	286.154	−461,677
4,300	37.855	142,368	−140,804	287.045	−469,330
4,400	37.897	146,156	−141,935	287.915	−476,957
4,500	37.936	149,948	−143,079	288.768	−484,558
4,600	37.970	153,743	−144,236	289.602	−492,134
4,700	37.998	157,541	−145,407	290.419	−499,684

ตาราง ก.4 Hydroxyl (OH), MW = 17.007, enthalpy of formation @ 298 K (kJ/kmol) = 38,985

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^o(T) - \bar{h}^o_f(298))$ (kJ/kmol)	$\bar{h}^o_f(T)$ (kJ/kmol)	$\bar{s}^o(T)$ (kJ/kmol-K)	$\bar{g}^o_f(T)$ (kJ/kmol)
200	30,140	−2,948	38,864	171.607	35,808
298	29,932	0	38,985	183.604	34,279
300	29,928	55	38,987	183.789	34,250
400	29,718	3,037	39,030	192.369	32,662
500	29,570	6,001	39,000	198.983	31,072
600	29,527	8,955	38,909	204.369	29,494
700	29,615	11,911	38,770	208.925	27,935
800	29,844	14,883	38,599	212.893	26,399
900	30,208	17,884	38,410	216.428	24,885
1,000	30,682	20,928	38,220	219.635	23,392
1,100	31,186	24,022	38,039	222.583	21,918
1,200	31,662	27,164	37,867	225.317	20,460
1,300	32,114	30,353	37,704	227.869	19,017
1,400	32,540	33,586	37,548	230.265	17,585
1,500	32,943	36,860	37,397	232.524	16,164
1,600	33,323	40,174	37,252	234.662	14,753
1,700	33,682	43,524	37,109	236.693	13,352
1,800	34,019	46,910	36,969	238.628	11,958
1,900	34,337	50,328	36,831	240.476	10,573
2,000	34,635	53,776	36,693	242.245	9,194
2,100	34,915	57,254	36,555	243.942	7,823
2,200	35,178	60,759	36,416	245.572	6,458
2,300	35,425	64,289	36,276	247.141	5,099
2,400	35,656	67,843	36,133	248.654	3,746
2,500	35,872	71,420	35,986	250.114	2,400
2,600	36,074	75,017	35,836	251.525	1,060
2,700	36,263	78,634	35,682	252.890	−275
2,800	36,439	82,269	35,524	254.212	−1,604
2,900	36,604	85,922	35,360	255.493	−2,927
3,000	36,759	89,590	35,191	256.737	−4,245
3,100	36,903	93,273	35,016	257.945	−5,556
3,200	37,039	96,970	34,835	259.118	−6,862
3,300	37,166	100,681	34,648	260.260	−8,162
3,400	37,285	104,403	34,454	261.371	−9,457
3,500	37,398	108,137	34,253	262.454	−10,745
3,600	37,504	111,882	34,046	263.509	−12,028
3,700	37,605	115,638	33,831	264.538	−13,305
3,800	37,701	119,403	33,610	265.542	−14,576
3,900	37,793	123,178	33,381	266.522	−15,841
4,000	37,882	126,962	33,146	267.480	−17,100
4,100	37,968	130,754	32,903	268.417	−18,353
4,200	38,052	134,555	32,654	269.333	−19,600
4,300	38,135	138,365	32,397	270.229	−20,841
4,400	38,217	142,182	32,134	271.107	−22,076
4,500	38,300	146,008	31,864	271.967	−23,306
4,600	38,382	149,842	31,588	272.809	−24,528
4,700	38,466	153,685	31,305	273.636	−25,745

ตาราง ก.5 Nitrogen (N_2), MW = 28.013, enthalpy of formation @ 298 K (kJ/kmol) = 0

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^o(T) - \bar{h}^o_f(298))$ (kJ/kmol)	$\bar{h}^o_f(T)$ (kJ/kmol)	$\bar{s}^o(T)$ (kJ/kmol-K)	$\bar{g}^o_f(T)$ (kJ/kmol)
200	28.793	-2,841	0	179.959	0
298	29.071	0	0	191.511	0
300	29.075	54	0	191.691	0
400	29.319	2,973	0	200.088	0
500	29.636	5,920	0	206.662	0
600	30.086	8,905	0	212.103	0
700	30.684	11,942	0	216.781	0
800	31.394	15,046	0	220.927	0
900	32.131	18,222	0	224.667	0
1,000	32.762	21,468	0	228.087	0
1,100	33.258	24,770	0	231.233	0
1,200	33.707	28,118	0	234.146	0
1,300	34.113	31,510	0	236.861	0
1,400	34.477	34,939	0	239.402	0
1,500	34.805	38,404	0	241.792	0
1,600	35.099	41,899	0	244.048	0
1,700	35.361	45,423	0	246.184	0
1,800	35.595	48,971	0	248.212	0
1,900	35.803	52,541	0	250.142	0
2,000	35.988	56,130	0	251.983	0
2,100	36.152	59,738	0	253.743	0
2,200	36.298	63,360	0	255.429	0
2,300	36.428	66,997	0	257.045	0
2,400	36.543	70,645	0	258.598	0
2,500	36.645	74,305	0	260.092	0
2,600	36.737	77,974	0	261.531	0
2,700	36.820	81,652	0	262.919	0
2,800	36.895	85,338	0	264.259	0
2,900	36.964	89,031	0	265.555	0
3,000	37.028	92,730	0	266.810	0
3,100	37.088	96,436	0	268.025	0
3,200	37.144	100,148	0	269.203	0
3,300	37.198	103,865	0	270.347	0
3,400	37.251	107,587	0	271.458	0
3,500	37.302	111,315	0	272.539	0
3,600	37.352	115,048	0	273.590	0
3,700	37.402	118,786	0	274.614	0
3,800	37.452	122,528	0	275.612	0
3,900	37.501	126,276	0	276.586	0
4,000	37.549	130,028	0	277.536	0
4,100	37.597	133,786	0	278.464	0
4,200	37.643	137,548	0	279.370	0
4,300	37.688	141,314	0	280.257	0
4,400	37.730	145,085	0	281.123	0
4,500	37.768	148,860	0	281.972	0
4,600	37.803	152,639	0	282.802	0
4,700	37.832	156,420	0	283.616	0

ตาราง ก.6 Water (H_2O), MW = 18.016, enthalpy of formation @ 298 K (kJ/kmol) = −241,845, enthalpy of vaporization (kJ/kmol) = 44,010

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^o(T) - \bar{h}^o_f(298))$ (kJ/kmol)	$\bar{h}^o_f(T)$ (kJ/kmol)	$\bar{s}^o(T)$ (kJ/kmol-K)	$\bar{g}^o_f(T)$ (kJ/kmol)
200	32.255	−3,227	−240,838	175.602	−232,779
298	33.448	0	−241,845	188.715	−228,608
300	33.468	62	−241,865	188.922	−228,526
400	34.437	3,458	−242,858	198.686	−223,929
500	35.337	6,947	−243,822	206.467	−219,085
600	36.288	10,528	−244,753	212.992	−214,049
700	37.364	14,209	−245,638	218.665	−208,861
800	38.587	18,005	−246,461	223.733	−203,550
900	39.930	21,930	−247,209	228.354	−198,141
1,000	41.315	25,993	−247,879	232.633	−192,652
1,100	42.638	30,191	−248,475	236.634	−187,100
1,200	43.874	34,518	−249,005	240.397	−181,497
1,300	45.027	38,963	−249,477	243.955	−175,852
1,400	46.102	43,520	−249,895	247.332	−170,172
1,500	47.103	48,181	−250,267	250.547	−164,464
1,600	48.035	52,939	−250,597	253.617	−158,733
1,700	48.901	57,786	−250,890	256.556	−152,983
1,800	49.705	62,717	−251,151	259.374	−147,216
1,900	50.451	67,725	−251,384	262.081	−141,435
2,000	51.143	72,805	−251,594	264.687	−135,643
2,100	51.784	77,952	−251,783	267.198	−129,841
2,200	52.378	83,160	−251,955	269.621	−124,030
2,300	52.927	88,426	−252,113	271.961	−118,211
2,400	53.435	93,744	−252,261	274.225	−112,386
2,500	53.905	99,112	−252,399	276.416	−106,555
2,600	54.340	104,524	−252,532	278.539	−100,719
2,700	54.742	109,979	−252,659	280.597	−94,878
2,800	55.115	115,472	−252,785	282.595	−89,031
2,900	55.459	121,001	−252,909	284.535	−83,181
3,000	55.779	126,563	−253,034	286.420	−77,326
3,100	56.076	132,156	−253,161	288.254	−71,467
3,200	56.353	137,777	−253,290	290.039	−65,604
3,300	56.610	143,426	−253,423	291.777	−59,737
3,400	56.851	149,099	−253,561	293.471	−53,865
3,500	57.076	154,795	−253,704	295.122	−47,990
3,600	57.288	160,514	−253,852	296.733	−42,110
3,700	57.488	166,252	−254,007	298.305	−36,226
3,800	57.676	172,011	−254,169	299.841	−30,338
3,900	57.856	177,787	−254,338	301.341	−24,446
4,000	58.026	183,582	−254,515	302.808	−18,549
4,100	58.190	189,392	−254,699	304.243	−12,648
4,200	58.346	195,219	−254,892	305.647	−6,742
4,300	58.496	201,061	−255,093	307.022	−831
4,400	58.641	206,918	−255,303	308.368	5,085
4,500	58.781	212,790	−255,522	309.688	11,005
4,600	58.916	218,674	−255,751	310.981	16,930
4,700	59.047	224,573	−255,990	312.250	22,861

ตาราง ก. 7 Nitrogen atom (N), MW = 14.007, enthalpy of formation @ 298 K (kJ/kmol) = 472,629

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^\circ(T) - \bar{h}^\circ_f(298))$ (kJ/kmol)	$\bar{h}^\circ_f(T)$ (kJ/kmol)	$\bar{s}^\circ(T)$ (kJ/kmol-K)	$\bar{g}^\circ_f(T)$ (kJ/kmol)
200	20.790	−2,040	472,008	144.889	461,026
298	20.786	0	472,629	153.189	455,504
300	20.786	38	472,640	153.317	455,398
400	20.786	2,117	473,258	159.297	449,557
500	20.786	4,196	473,864	163.935	443,562
600	20.786	6,274	474,450	167.725	437,446
700	20.786	8,353	475,010	170.929	431,234
800	20.786	10,431	475,537	173.705	424,944
900	20.786	12,510	476,027	176.153	418,590
1,000	20.786	14,589	476,483	178.343	412,183
1,100	20.792	16,668	476,911	180.325	405,732
1,200	20.795	18,747	477,316	182.134	399,243
1,300	20.795	20,826	477,700	183.798	392,721
1,400	20.793	22,906	478,064	185.339	386,171
1,500	20.790	24,985	478,411	186.774	379,595
1,600	20.786	27,064	478,742	188.115	372,996
1,700	20.782	29,142	479,059	189.375	366,377
1,800	20.779	31,220	479,363	190.563	359,740
1,900	20.777	33,298	479,656	191.687	353,086
2,000	20.776	35,376	479,939	192.752	346,417
2,100	20.778	37,453	480,213	193.766	339,735
2,200	20.783	39,531	480,479	194.733	333,039
2,300	20.791	41,610	480,740	195.657	326,331
2,400	20.802	43,690	480,995	196.542	319,612
2,500	20.818	45,771	481,246	197.391	312,883
2,600	20.838	47,853	481,494	198.208	306,143
2,700	20.864	49,938	481,740	198.995	299,394
2,800	20.895	52,026	481,985	199.754	292,636
2,900	20.931	54,118	482,230	200.488	285,870
3,000	20.974	56,213	482,476	201.199	279,094
3,100	21.024	58,313	482,723	201.887	272,311
3,200	21.080	60,418	482,972	202.555	265,519
3,300	21.143	62,529	483,224	203.205	258,720
3,400	21.214	64,647	483,481	203.837	251,913
3,500	21.292	66,772	483,742	204.453	245,099
3,600	21.378	68,905	484,009	205.054	238,276
3,700	21.472	71,048	484,283	205.641	231,447
3,800	21.575	73,200	484,564	206.215	224,610
3,900	21.686	75,363	484,853	206.777	217,765
4,000	21.805	77,537	485,151	207.328	210,913
4,100	21.934	79,724	485,459	207.868	204,053
4,200	22.071	81,924	485,779	208.398	197,186
4,300	22.217	84,139	486,110	208.919	190,310
4,400	22.372	86,368	486,453	209.431	183,427
4,500	22.536	88,613	486,811	209.936	176,536
4,600	22.709	90,875	487,184	210.433	169,637
4,700	22.891	93,155	487,573	210.923	162,730

ตาราง ก.8 Nitric oxide (NO), MW = 30.006, enthalpy of formation @ 298 K (kJ/kmol) = 90,297

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^o(T) - \bar{h}^o_f(298))$ (kJ/kmol)	$\bar{h}^o_f(T)$ (kJ/kmol)	$\bar{s}^o(T)$ (kJ/kmol-K)	$\bar{g}^o_f(T)$ (kJ/kmol)
200	29.374	−2,901	90,234	198.856	87,811
298	29.728	0	90,297	210.652	86,607
300	29.735	55	90,298	210.836	86,584
400	30.103	3,046	90,341	219.439	85,340
500	30.570	6,079	90,367	226.204	84,086
600	31.174	9,165	90,382	231.829	82,828
700	31.908	12,318	90,393	236.688	81,568
800	32.715	15,549	90,405	241.001	80,307
900	33.489	18,860	90,421	244.900	79,043
1,000	34.076	22,241	90,443	248.462	77,778
1,100	34.483	25,669	90,465	251.729	76,510
1,200	34.850	29,136	90,486	254.745	75,241
1,300	35.180	32,638	90,505	257.548	73,970
1,400	35.474	36,171	90,520	260.166	72,697
1,500	35.737	39,732	90,532	262.623	71,423
1,600	35.972	43,317	90,538	264.937	70,149
1,700	36.180	46,925	90,539	267.124	68,875
1,800	36.364	50,552	90,534	269.197	67,601
1,900	36.527	54,197	90,523	271.168	66,327
2,000	36.671	57,857	90,505	273.045	65,054
2,100	36.797	61,531	90,479	274.838	63,782
2,200	36.909	65,216	90,447	276.552	62,511
2,300	37.008	68,912	90,406	278.195	61,243
2,400	37.095	72,617	90,358	279.772	59,976
2,500	37.173	76,331	90,303	281.288	58,711
2,600	37.242	80,052	90,239	282.747	57,448
2,700	37.305	83,779	90,168	284.154	56,188
2,800	37.362	87,513	90,089	285.512	54,931
2,900	37.415	91,251	90,003	286.824	53,677
3,000	37.464	94,995	89,909	288.093	52,426
3,100	37.511	98,744	89,809	289.322	51,178
3,200	37.556	102,498	89,701	290.514	49,934
3,300	37.600	106,255	89,586	291.670	48,693
3,400	37.643	110,018	89,465	292.793	47,456
3,500	37.686	113,784	89,337	293.885	46,222
3,600	37.729	117,555	89,203	294.947	44,992
3,700	37.771	121,330	89,063	295.981	43,766
3,800	37.815	125,109	88,918	296.989	42,543
3,900	37.858	128,893	88,767	297.972	41,325
4,000	37.900	132,680	88,611	298.931	40,110
4,100	37.943	136,473	88,449	299.867	38,900
4,200	37.984	140,269	88,283	300.782	37,693
4,300	38.023	144,069	88,112	301.677	36,491
4,400	38.060	147,873	87,936	302.551	35,292
4,500	38.093	151,681	87,755	303.407	34,098
4,600	38.122	155,492	87,569	304.244	32,908
4,700	38.146	159,305	87,379	305.064	31,721

ตาราง ก.9 Nitrogen dioxide (NO_2), MW = 46.006, enthalpy of formation @ 298 K (kJ/kmol) = 33,098

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^o(T) - \bar{h}^o_f(298))$ (kJ/kmol)	$\bar{h}^o_f(T)$ (kJ/kmol)	$\bar{s}^o(T)$ (kJ/kmol-K)	$\bar{g}^o_f(T)$ (kJ/kmol)
200	32,936	−3,432	33,961	226,016	45,453
298	36,881	0	33,098	239,925	51,291
300	36,949	68	33,085	240,153	51,403
400	40,331	3,937	32,521	251,259	57,602
500	43,227	8,118	32,173	260,578	63,916
600	45,737	12,569	31,974	268,686	70,285
700	47,913	17,255	31,885	275,904	76,679
800	49,762	22,141	31,880	282,427	83,079
900	51,243	27,195	31,938	288,377	89,476
1,000	52,271	32,375	32,035	293,834	95,864
1,100	52,989	37,638	32,146	298,850	102,242
1,200	53,625	42,970	32,262	303,489	108,609
1,300	54,186	48,361	32,392	307,804	114,966
1,400	54,679	53,805	32,519	311,838	121,313
1,500	55,109	59,295	32,643	315,625	127,651
1,600	55,483	64,825	32,762	319,194	133,981
1,700	55,805	70,390	32,873	322,568	140,303
1,800	56,082	75,984	32,973	325,765	146,620
1,900	56,318	81,605	33,061	328,804	152,931
2,000	56,517	87,247	33,134	331,698	159,238
2,100	56,685	92,907	33,192	334,460	165,542
2,200	56,826	98,583	33,233	337,100	171,843
2,300	56,943	104,271	33,256	339,629	178,143
2,400	57,040	109,971	33,262	342,054	184,442
2,500	57,121	115,679	33,248	344,384	190,742
2,600	57,188	121,394	33,216	346,626	197,042
2,700	57,244	127,116	33,165	348,785	203,344
2,800	57,291	132,843	33,095	350,868	209,648
2,900	57,333	138,574	33,007	352,879	215,955
3,000	57,371	144,309	32,900	354,824	222,265
3,100	57,406	150,048	32,776	356,705	228,579
3,200	57,440	155,791	32,634	358,529	234,898
3,300	57,474	161,536	32,476	360,297	241,221
3,400	57,509	167,285	32,302	362,013	247,549
3,500	57,546	173,038	32,113	363,680	253,883
3,600	57,584	178,795	31,908	365,302	260,222
3,700	57,624	184,555	31,689	366,880	266,567
3,800	57,665	190,319	31,456	368,418	272,918
3,900	57,708	196,088	31,210	369,916	279,276
4,000	57,750	201,861	30,951	371,378	285,639
4,100	57,792	207,638	30,678	372,804	292,010
4,200	57,831	213,419	30,393	374,197	298,387
4,300	57,866	219,204	30,095	375,559	304,772
4,400	57,895	224,992	29,783	376,889	311,163
4,500	57,915	230,783	29,457	378,190	317,562
4,600	57,925	236,575	29,117	379,464	323,968
4,700	57,922	242,367	28,761	380,709	330,381

ตาราง ก.10 Oxygen (O_2), MW = 31.999, entholpy of formation @ 298 K (kJ/kmol) =

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^o(T) - \bar{h}^o_f(298))$ (kJ/kmol)	$\bar{h}^o_f(T)$ (kJ/kmol)	$\bar{s}^o(T)$ (kJ/kmol-K)	$\bar{g}^o_f(T)$ (kJ/kmol)
200	28.473	−2,836	0	193.518	0
298	29.315	0	0	205.043	0
300	29.331	54	0	205.224	0
400	30.210	3,031	0	213.782	0
500	31.114	6,097	0	220.620	0
600	32.030	9,254	0	226.374	0
700	32.927	12,503	0	231.379	0
800	33.757	15,838	0	235.831	0
900	34.454	19,250	0	239.849	0
1,000	34.936	22,721	0	243.507	0
1,100	35.270	26,232	0	246.852	0
1,200	35.593	29,775	0	249.935	0
1,300	35.903	33,350	0	252.796	0
1,400	36.202	36,955	0	255.468	0
1,500	36.490	40,590	0	257.976	0
1,600	36.768	44,253	0	260.339	0
1,700	37.036	47,943	0	262.577	0
1,800	37.296	51,660	0	264.701	0
1,900	37.546	55,402	0	266.724	0
2,000	37.788	59,169	0	268.656	0
2,100	38.023	62,959	0	270.506	0
2,200	38.250	66,773	0	272.280	0
2,300	38.470	70,609	0	273.985	0
2,400	38.684	74,467	0	275.627	0
2,500	38.891	78,346	0	277.210	0
2,600	39.093	82,245	0	278.739	0
2,700	39.289	86,164	0	280.218	0
2,800	39.480	90,103	0	281.651	0
2,900	39.665	94,060	0	283.039	0
3,000	39.846	98,036	0	284.387	0
3,100	40.023	102,029	0	285.697	0
3,200	40.195	106,040	0	286.970	0
3,300	40.362	110,068	0	288.209	0
3,400	40.526	114,112	0	289.417	0
3,500	40.686	118,173	0	290.594	0
3,600	40.842	122,249	0	291.742	0
3,700	40.994	126,341	0	292.863	0
3,800	41.143	130,448	0	293.959	0
3,900	41.287	134,570	0	295.029	0
4,000	41.429	138,705	0	296.076	0
4,100	41.566	142,855	0	297.101	0
4,200	41.700	147,019	0	298.104	0
4,300	41.830	151,195	0	299.087	0
4,400	41.957	155,384	0	300.050	0
4,500	42.079	159,586	0	300.994	0
4,600	42.197	163,800	0	301.921	0
4,700	42.312	168,026	0	302.829	0

ตาราง ก. 11 Oxygen atom (O), MW = 16.000, enthalpy of formation @ 298K (kJ/kmol) = 249,197

T(K)	$\bar{c}_p$ (kJ/kmol-K)	$(\bar{h}^o(T) - \bar{h}^o_f(298))$ (kJ/kmol)	$\bar{h}^o_f(T)$ (kJ/kmol)	$\bar{s}^o(T)$ (kJ/kmol-K)	$\bar{g}^o_f(T)$ (kJ/kmol)
200	22.477	−2,176	248,439	152.085	237,374
298	21.899	0	249,197	160.945	231,778
300	21.890	41	249,211	161.080	231,670
400	21.500	2,209	249,890	167.320	225,719
500	21.256	4,345	250,494	172.089	219,605
600	21.113	6,463	251,033	175.951	213,375
700	21.033	8,570	251,516	179.199	207,060
800	20.986	10,671	251,949	182.004	200,679
900	20.952	12,768	252,340	184.474	194,246
1,000	20.915	14,861	252,698	186.679	187,772
1,100	20.898	16,952	253,033	188.672	181,263
1,200	20.882	19,041	253,350	190.490	174,724
1,300	20.867	21,128	253,650	192.160	168,159
1,400	20.854	23,214	253,934	193.706	161,572
1,500	20.843	25,299	254,201	195.145	154,966
1,600	20.834	27,383	254,454	196.490	148,342
1,700	20.827	29,466	254,692	197.753	141,702
1,800	20.822	31,548	254,916	198.943	135,049
1,900	20.820	33,630	255,127	200.069	128,384
2,000	20.819	35,712	255,325	201.136	121,709
2,100	20.821	37,794	255,512	202.152	115,023
2,200	20.825	39,877	255,687	203.121	108,329
2,300	20.831	41,959	255,852	204.047	101,627
2,400	20.840	44,043	256,007	204.933	94,918
2,500	20.851	46,127	256,152	205.784	88,203
2,600	20.865	48,213	256,288	206.602	81,483
2,700	20.881	50,300	256,416	207.390	74,757
2,800	20.899	52,389	256,535	208.150	68,027
2,900	20.920	54,480	256,648	208.884	61,292
3,000	20.944	56,574	256,753	209.593	54,554
3,100	20.970	58,669	256,852	210.280	47,812
3,200	20.998	60,768	256,945	210.947	41,068
3,300	21.028	62,869	257,032	211.593	34,320
3,400	21.061	64,973	257,114	212.221	27,570
3,500	21.095	67,081	257,192	212.832	20,818
3,600	21.132	69,192	257,265	213.427	14,063
3,700	21.171	71,308	257,334	214.007	7,307
3,800	21.212	73,427	257,400	214.572	548
3,900	21.254	75,550	257,462	215.123	−6,212
4,000	21.299	77,678	257,522	215.662	−12,974
4,100	21.345	79,810	257,579	216.189	−19,737
4,200	21.392	81,947	257,635	216.703	−26,501
4,300	21.441	84,088	257,688	217.207	−33,267
4,400	21.490	86,235	257,740	217.701	−40,034
4,500	21.541	88,386	257,790	218.184	−46,802
4,600	21.593	90,543	257,840	218.658	−53,571
4,700	21.646	92,705	257,889	219.123	−60,342

ตาราง ก.13 Selected properties of air at 1 atm[a]

T (K)	ρ (kg/m^3)	c_p (kJ/kg-K)	$\mu \cdot 10^7$ (N-s/m^2)	$\nu \cdot 10^6$ (m^2/s)	$k \cdot 10^3$ (W/m-K)	$\alpha \cdot 10^6$ (m^2/s)	Pr
100	3.5562	1.032	71.1	2.00	9.34	2.54	0.786
150	2.3364	1.012	103.4	4.426	13.8	5.84	0.758
200	1.7458	1.007	132.5	7.590	18.1	10.3	0.737
250	1.3947	1.006	159.6	11.44	22.3	15.9	0.720
300	1.1614	1.007	184.6	15.89	26.3	22.5	0.707
350	0.9950	1.009	208.2	20.92	30.0	29.9	0.700
400	0.8711	1.014	230.1	26.41	33.8	38.3	0.690
450	0.7740	1.021	250.7	32.39	37.3	47.2	0.686
500	0.6964	1.030	270.1	38.79	40.7	56.7	0.684
550	0.6329	1.040	288.4	45.57	43.9	66.7	0.683
600	0.5804	1.051	305.8	52.69	46.9	76.9	0.685
650	0.5356	1.063	322.5	60.21	49.7	87.3	0.690
700	0.4975	1.075	338.8	68.10	52.4	98.0	0.695
750	0.4643	1.087	354.6	76.37	54.9	109	0.702
800	0.4354	1.099	369.8	84.93	57.3	120	0.709
850	0.4097	1.110	384.3	93.80	59.6	131	0.716
900	0.3868	1.121	398.1	102.9	62.0	143	0.720
950	0.3666	1.131	411.3	112.2	64.3	155	0.723
1,000	0.3482	1.141	424.4	121.9	66.7	168	0.726
1,100	0.3166	1.159	449.0	141.8	71.5	195	0.728
1,200	0.2902	1.175	473.0	162.9	76.3	224	0.728
1,300	0.2679	1.189	496.0	185.1	82	238	0.719
1,400	0.2488	1.207	530	213	91	303	0.703
1,500	0.2322	1.230	557	240	100	350	0.685
1,600	0.2177	1.248	584	268	106	390	0.688

ตาราง ก. 12 Selected properties of hydrocarbon fuels: enthalpy of formation,[a] Gibbs function of formation,[a] entropy,[a] and higher and lower heating values all at 298.15 K and 1 atm; boiling points[b] and latent heat of vaporization[c] at 1 atm; constant-pressure adiabatic flame temperature at 1 atm;[d] liquid density[c]

Formula	Fuel	MW (kg/kmol)	$\bar{h}_f^o$ (kJ/kmol)	$\bar{g}_f^o$ (kJ/kmol)	$\bar{s}^o$ (kJ/kmol-K)	HHV[f] (kJ/kg)	LHV[f] (kJ/kg)	Boiling pt. (°C)	h_{fg} (kJ/kg)	T_{ad}[f] (K)	ρ_{liq} (kg/m³)
CH_4	Methane	16.043	−74,831	−50,794	186.188	55,528	50,016	−164	509	2,226	300
C_2H_2	Acetylene	26.038	226,748	209,200	200.819	49,923	48,225	−84	—	2,539	—
C_2H_4	Ethene	28.054	52,283	68,124	219.827	50,313	47,161	−103.7	—	2,369	—
C_2H_6	Ethane	30.069	−84,667	−32,886	229.492	51,901	47,489	−88.6	488	2,259	370
C_3H_6	Propene	42.080	20,414	62,718	266.939	48,936	45,784	−47.4	437	2,334	514
C_3H_8	Propane	44.096	−103,847	−23,489	269.910	50,368	46,357	−42.1	425	2,267	500
C_4H_8	1-Butene	56.107	1,172	72,036	307.440	48,471	45,319	−63	391	2,322	595
C_4H_{10}	*n*-Butane	58.123	−124,733	−15,707	310.034	49,546	45,742	−0.5	386	2,270	579
C_5H_{10}	1-Pentene	70.134	−20,920	78,605	347.607	48,152	45,000	30	358	2,314	641
C_5H_{12}	*n*-Pentane	72.150	−146,440	−8,201	348.402	49,032	45,355	36.1	358	2,272	626
C_6H_6	Benzene	78.113	82,927	129,658	269.199	42,277	40,579	80.1	393	2,342	879
C_6H_{12}	1-Hexene	84.161	−41,673	87,027	385.974	47,955	44,803	63.4	335	2,308	673
C_6H_{14}	*n*-Hexane	86.177	−167,193	209	386.811	48,696	45,105	69	335	2,273	659
C_7H_{14}	1-Heptene	98.188	−62,132	95,563	424.383	47,817	44,665	93.6	—	2,305	—
C_7H_{16}	*n*-Heptane	100.203	−187,820	8,745	425.262	48,456	44,926	98.4	316	2,274	684
C_8H_{16}	1-Octene	112.214	−82,927	104,140	462.792	47,712	44,560	121.3	—	2,302	—
C_8H_{18}	*n*-Octane	114.230	−208,447	17,322	463.671	48,275	44,791	125.7	300	2,275	703
C_9H_{18}	1-Nonene	126.241	−103,512	112,717	501.243	47,631	44,478	—	—	2,300	—
C_9H_{20}	*n*-Nonane	128.257	−229,032	25,857	502.080	48,134	44,686	150.8	295	2,276	718
$C_{10}H_{20}$	1-Decene	140.268	−124,139	121,294	539.652	47,565	44,413	170.6	—	2,298	—
$C_{10}H_{22}$	*n*-Decane	142.284	−249,659	34,434	540.531	48,020	44,602	174.1	277	2,277	730
$C_{11}H_{22}$	1-Undecene	154.295	−144,766	129,830	578.061	47,512	44,360	—	—	2,296	—
$C_{11}H_{24}$	*n*-Undecane	156.311	−270,286	43,012	578.940	47,926	44,532	195.9	265	2,277	740

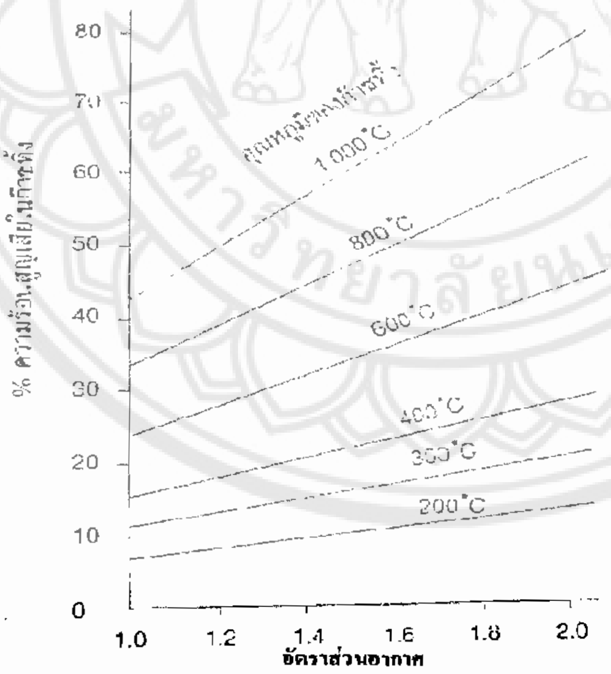
ตาราง ก.14 Selected properties of nitrogen and oxygen at 1 atm[a]

T (K)	ρ (kg/m^3)	c_p (kJ/kg·K)	$\mu \cdot 10^7$ (N·s/m^2)	$\nu \cdot 10^6$ (m^2/s)	$k \cdot 10^3$ (W/m·K)	$\alpha \cdot 10^6$ (m^2/s)	Pr
Nitrogen (N_2)							
100	3.4388	1.070	68.8	2.00	9.58	2.60	0.768
150	2.2594	1.050	100.6	4.45	13.9	5.86	0.759
200	1.6883	1.043	129.2	7.65	18.3	10.4	0.736
250	1.3488	1.042	154.9	11.48	22.2	15.8	0.727
300	1.1233	1.041	178.2	15.86	25.9	22.1	0.716
350	0.9625	1.042	200.0	20.78	29.3	29.2	0.711
400	0.8425	1.045	220.4	26.16	32.7	37.1	0.704
450	0.7485	1.050	239.6	32.01	35.8	45.6	0.703
500	0.6739	1.056	257.7	38.24	38.9	54.7	0.700
550	0.6124	1.065	274.7	44.86	41.7	63.9	0.702
600	0.5615	1.075	290.8	51.79	44.6	73.9	0.701
700	0.4812	1.098	321.0	66.71	49.9	94.4	0.706
800	0.4211	1.122	349.1	82.90	54.8	116	0.715
900	0.3743	1.146	375.3	100.3	59.7	139	0.721
1,000	0.3368	1.167	399.9	118.7	64.7	165	0.721
1,100	0.3062	1.187	423.2	138.2	70.0	193	0.718
1,200	0.2807	1.204	445.3	158.6	75.8	224	0.707
1,300	0.2591	1.219	466.2	179.9	81.0	256	0.701
Oxygen (O_2)							
100	3.945	0.962	76.4	1.94	9.25	2.44	0.796
150	2.585	0.921	114.8	4.44	13.8	5.80	0.766
200	1.930	0.915	147.5	7.64	18.3	10.4	0.737
250	1.542	0.915	178.6	11.58	22.6	16.0	0.723
300	1.284	0.920	207.2	16.14	26.8	22.7	0.711
350	1.100	0.929	233.5	21.23	29.6	29.0	0.733
400	0.9620	0.942	258.2	26.84	33.0	36.4	0.737
450	0.8554	0.956	281.4	32.90	36.3	44.4	0.741
500	0.7698	0.972	303.3	39.40	41.2	55.1	0.716
550	0.6998	0.988	324.0	46.30	44.1	63.8	0.726
600	0.6414	1.003	343.7	53.59	47.3	73.5	0.729
700	0.5498	1.031	380.8	69.26	52.8	93.1	0.744
800	0.4810	1.054	415.2	86.32	58.9	116	0.743
900	0.4275	1.074	447.2	104.6	64.9	141	0.740
1,000	0.3848	1.090	477.0	124.0	71.0	169	0.733
1,100	0.3498	1.103	505.5	144.5	75.8	196	0.736
1,200	0.3206	1.115	532.5	166.1	81.9	229	0.725
1,300	0.2960	1.125	588.4	188.6	87.1	262	0.721

ภาคผนวก ข.

ตาราง ข.1 อัตราส่วนอากาศมาตรฐานสำหรับเตาอุตสาหกรรม (Industrial furnace)

ประเภท	อัตราส่วนอากาศมาตรฐาน
เตาหลอมสำหรับหล่อโลหะ	1.3
เตาให้ความร้อนชิ้นเหล็กกล้าอย่างต่อเนื่อง	1.25
เตาให้ความร้อนโลหะที่ไม่ใช้เตาให้ความร้อนชิ้นเหล็กกล้าอย่างต่อเนื่อง	1.3
เตา Heat Treatment อย่างต่อเนื่อง	1.3
เตาผลิตก๊าซและเตาให้ความร้อนก๊าซ	1.4
เตาให้ความร้อนแก่น้ำมันเตา	1.4
เตา Thermal Cracking และเตาปรุงแต่งคุณภาพ	1.3
เตาเผาซีเมนต์	1.3
เตาเผาอะลูมินาและเตาเผาปูนขาว	1.4
เตาหลอมละลายแก้วอย่างต่อเนื่อง	1.3



กราฟที่ ข.2 ความสัมพันธ์ระหว่างอัตราส่วนอากาศกับความร้อนสูญเสียในก๊าซทิ้ง

ภาคผนวก ค.

ตัวอย่างการคำนวณ Adiabatic Flame Temperature โดยใช้โปรแกรม HPFLAME

ตัวอย่าง แสดงขั้นตอนการหา Adiabatic flame temperature ที่อุณหภูมิอากาศ 298 K โดยใช้โปรแกรม HPFLAME

1) ใส่ค่าต่างๆจากการคำนวณที่ผ่านมา ดังนี้

Adiabatic Flame Calculation for Specified Fuel, Phi, P, & Reactant

Enthalpy Using Olikara & Borman Equilibrium Routines

Problem Title: USER SPECIFIES TITLE HERE

1.475 /CARBON ATOMS IN FUEL

4.5 /HYDROGEN ATOMS IN FUEL

0.6 /OXYGEN ATOMS IN FUEL

0.05 /NITROGEN ATOMS IN FUEL

0.80 /EQUIVALENCE RATIO

1000 /TEMPERATURE (K) (Initial Guess)

101325.0 /PRESSURE (Pa.)

-81543.725 /ENTHALPY OF REACTANTS PER KMOL FUEL (kJ/kmol-fuel)

2) กด Save&Run จะได้

Adiabatic Flame Calculation for Specified Fuel, Phi, P, & Reactant

Enthalpy Using Olikara & Borman Equilibrium Routines

Problem Title: USER SPECIFIES TITLE HERE

Data below are as read from the input file. Compare with INPUT.HP. If they do not agree, your input data have not been entered correctly.

CARBON ATOMS 1.5 OXYGEN ATOMS 0.6

HYDROGEN ATOMS 4.5 NITROGEN ATOMS 0.1

EQUIVALENCE RATIO 0.800

TEMPERATURE (K) guess 1000.0

PRESSURE (Pa) 101325.0

ENTHALPY OF REACTANTS (kJ/kmol fuel) -81543.7

FLAME TEMP. & COMBUSTION PRODUCTS PROPERTIES

Flame Temperature [K] = 2126.16

Mixture Enthalpy [J/kg] = -0.1908E+06

Mixture Specific Heat, Cp [J/kg-K] = 0.174287E+04

Specific Heat Ratio, Cp/Cv = 1.2106

Mixture Molecular Weight [kg/kmol] = 28.1787

Moles of Fuel per Mole of Products = 0.06593431

The mole fractions of the product species are:

H: 0.00008515	O: 0.00031365	N: 0.00000000
H2: 0.00054613	OH: 0.00282649	CO: 0.00176774
NO: 0 .00442726	O2: 0.03601337	H2O: 0.14635024
CO2: 0.09548536	N2: 0.71218459	H2O: 0.14635024

3) เมื่อโปรแกรมทำการประมวลผลแล้ว จะได้ค่า Adiabatic flame temperature ที่อุณหภูมิของอากาศที่เข้าห้องเผาไหม้ 298 K รวมถึงค่าต่างๆ แต่ในที่นี้ใช้เพียงค่า Adiabatic flame temperature หลังจากนั้นสามารถหาค่า Adiabatic flame temperature ที่อุณหภูมิของอากาศใดๆที่เข้าห้องเผาไหม้ได้ โดยใส่ค่าเอนทาลปี ของสารตั้งต้นที่ได้คำนวณไว้ในตารางที่3.6

ภาคผนวก ง.

ตัวอย่างตารางบันทึกข้อมูลการใช้เชื้อเพลิง และก้อนอลูมิเนียมที่ทำการหลอมในแต่ละวัน

MELTING DAILY REPORT

DATE 5/1/49 SHIFT WHITE YELLOW DAY NIGHT AL-DC1 AL-DC2 AL-DC3

TEMPERATURE RECORD

TIME							
8:00							295909
9:00							295949
10:00							296028
11:00							296085
12:00							296139
13:00							296183
14:00							296213
15:00							296270
16:00							296334
17:00							296381
18:00							296405
19:00							296447
20:00							296468
			TOTAL GAS USED (M)				559

FLUX FEED

TIME START	TIME STOP					FLUX BY

TABAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

[illegible] AL - [illegible] Start Line........Ton Check By............

- [illegible] Stop Line........Ton Check By............

[illegible] N

- 11.30 - 23.30 CHECK BY ....

- 18.00 - 06.00 CHECK BY ....

FILTER [illegible]

REMARK

MATERIAL CHARGING

CHECK BY วสุรัตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
8:20			240.5		98.5		
08:25			259.5				
08:55				252			
9:10			272				
9:25			249				
9:50				252			
10:15			231				
10:25						248	
10:35			233				
10:55			250.5				
11:30				252			
11:35			252				
11:50			228.5				
13:30				252			
13:40			235				
13:45			231				
14:00				252			
14:10			251.5				
14:40			262.5				
15:10				252			
15:40			237				
15:10			227.5				
15:20				252			
15:30			249				
15:50			246				
16:00			249				
17:10			246.5				
TOTAL	KG	KG	3656 KG	1764 KG	98.5 KG	248 KG	KG
WEIGHT	6653 KG.						

MELTING DAILY REPORT

DATE 5/1/49 SHIFT ✓ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☐ AL-DC3 ☑

TEMPERATURE RECORD

TIME							
8:00							301003
9:00							301063
10:00							301123
11:00							301177
12:00							301228
13:00							301319
14:00							301336
15:00							301338
16:00							301384
17:00							301432
18:00							301473
19:00							301494
20:00							301546
			TOTAL GAS USED (M³)				552

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line.......Ton Check By...........

- Stop Line.......Ton Check By...........

N

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RISER	C/H	C/H	SCRAP
17:00			246				
20:05							50
20:20					250		
20:30				252			
20:45				252			
21:10				238.5			
21:20				253			
21:30					252		
22:00				242			
22:10				263			
22:30					252		
22:40				244.5			
23:00				234			
23:20					252		
23:30				245.5			
01:15				240.5			
01:25					252		
01:35				234.5			
01:45				249.5			
02:05					252		
02:15				257			
02:25				239.5			
02:40					252		
03:15				250.5			
03:25				254			
TOTAL	KG	KG	3702 KG	3061 KG	250 KG	KG	50 KG
WEIGHT	6018 KG.						

MELTING DAILY REPORT

DATE 6/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							297020
21:00							297071
22:00							297134
23:00							297205
0:00							297251
1:00							297282
2:00							297306
3:00							297361
4:00							297415
5:00							297447
6:00							297518
7:00							297530
8:00							297556
			TOTAL GAS USED (M)				546

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT			
Cu			
Si			
Mg			
Zn			
Fe			
Mn			
Ni			
Ti			
Pb			
Sn			
Cr			
Ca			

AL – Start Line........Ton Check By............

– Stop Line........Ton Check By............

N_2

– 11.30-23.30 CHECK BY................................

– 18.00-06.00 CHECK BY................................

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY วสุจิตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
06:00			221				
06:10			248				
06:20							80
07:15			243.5				
07:20			251.5				
08:10			239				
08:20			238				
08:30				252			
09:10			244.5				
09:30			247				
09:40				252			
10:10			252				
10:30			250				
10:50				252			
11:10			235				
11:30				252			
11:40			250				
13:40			244				
13:45				252			
14:00			252				
14:05			253				
14:20				252			
14:55			251				
15:00			251				
15:30				252			
16:45			251				
16:50			247				
16:55				252			
17:00			254				
17:30			254				
TOTAL	KG	2507 KG	2579 KG	2016 KG	KG	KG	80 KG
WEIGHT	7282 KG.						

MELTING DAILY REPORT

DATE 6/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							297556
21:00							297599
22:00							297669
23:00							297736
0:00							297786
1:00							297820
2:00							297854
3:00							297919
4:00							297971
5:00							298004
6:00							298020
7:00							298031
8:00							298079
			TOTAL GAS USED (M)				523

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line........Ton Check By............

\- Stop Line........Ton Check By............

N

\- 11.30-23.30 CHECK BY ....

\- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING

CHECK BY เกรียงไกร

TIME	INGOT			RIDER	C/H	C/H	SCAP
20:15							50
20:20		215					
20:30				252			
20:40		242					
20:50		250					
21:00		248					
21:15		254					
21:30							
21:45				252			
22:00		246					
22:30		248					
22:40				252			
23:20		243					
23:35		251					
01:15				252			
01:20		253					
01:40		294					
01:50				252			
02:55		247					
02:30		241					
03:10				252			
03:15		244					
06:45		244					
06:55				252			
07:05		256					
07:15		255					
07:30		246					
TOTAL	KG	4477 KG	KG	1764 KG	KG	KG	50 KG
WEIGHT	6291 KG.						

MELTING DAILY REPORT

DATE 7/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8:00							298079
9:00							298106
10:00							298168
11:00							298232
12:00							298292
13:00							298323
14:00							298357
15:00							298418
16:00							298464
17:00							298507
18:00							298548
19:00							298559
20:00							298568
			TOTALGAS USED (M)				489

FLUX FEED

TIME START	TIME STOP	[illegible]	[illegible]	[illegible]	[illegible]	FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Cl		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

[illegible] AL – [illegible] Start Line........Ton Check By............

– [illegible] Stop Line........Ton Check By............

[illegible] N.

- 11:30-23:30 CHECK BY ....
- 18:00-06:00 CHECK BY ....

FILTER [illegible] ☐ [illegible] ☐ [illegible]

REMARK

MATERIAL CHARGING CHECK BY วสุจิตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
08:45		250					
08:50		242					
08:55				252			
09:00		252					
09:10		253					
09:20				252			
09:40		253					
10:10		254					
10:20						248	
10:30		253					
11:00		253					
11:20						248	
11:30		235					
13:40		251					
13:50				252			
14:00		237					
14:10		247					
14:30				252			
15:10		245					
15:30		250					
17:00				252			
17:10		251					
17:20		242					
17:30							57
TOTAL	KG	3968 KG	KG	1260 KG	KG	496 KG	57 KG
WEIGHT	5781 KG.						

MELTING DAILY REPORT

DATE 7/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							298558
9:00							298578
10:00							298626
11:00							298688
12:00							298763
13:00							298792
14:00							298850
15:00							298899
16:00							298951
17:00							299002
18:00							299016
19:00							299034
20:00							299047
			TOTAL GAS USED (M)				479

FLUX FEED

TIME START	TIME STOP					FLUX BY

TABAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line.......Ton Check By ....

- Stop Line........Ton Check By ....

N

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING — CHECK BY เกรียงไกร

TIME	INGOT			RISER	C/H	C/H	SCAP
21:15		254					
21:25		253					
21:35		244					
21:55		252					
22:15				252			
22:30		247					
22:45		251					
22:56				252			
23:10		248					
23:15		247					
23:25				252			
23:50		251					
01:25		246					
01:35				252			
01:40		250					
02:15		249					
02:25				252			
02:35		244					
02:55		246					
03:15				252			
03:30		246					
TOTAL	KG	3728 KG	KG	1512 KG	KG	KG	KG
WEIGHT				5240 KG.			

MELTING DAILY REPORT

DATE 8/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME						
20:00						299047
21:00						299054
22:00						299065
23:00						299077
0:00						299085
1:00						299100
2:00						299109
3:00						299119
4:00						299130
5:00						299142
6:00						299159
7:00						299167
8:00						299175
			TOTAL GAS USED (M³)			128

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL Start Line........Ton Check By..........

Stop Line........Ton Check By..........

- 11:30-23:30 CHECK BY ....
- 18:00-06:00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING

CHECK BY วสุรัตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
06:00							
06:15	247						
06:30				252			
06:40	251						
06:20	257						
09:40				252			
09:50	276						
10:00	274						
10:10				252			
10:20	246						
10:30	254						
11:00				252			
11:05				252			
11:25	242						
11:40	245						
11:50	254			63			
14:00	250						
14:10	243						
14:20				252			
14:40	243						
14:50	246						
15:00	244			83			
15:15				252			
15:25	247						
16:00	246						
16:35				252			
17:00	245						
TOTAL	4325 KG	KG	KG	1337 KG	KG	KG	KG
WEIGHT	5662 KG.						

MELTING DAILY REPORT

DATE 8/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							299175
21:00							299213
22:00							299257
23:00							299269
0:00							299280
1:00							299297
2:00							299309
3:00							299318
4:00							299335
5:00							299350
6:00							299359
7:00							299380
8:00							299392
			TOTAL GAS USED (M)				217

FLUX FEED

TIME START	TIME STOP					FLUX BY

TABAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL – Start Line........Ton Check By ....

– Stop Line........Ton Check By ....

N_2

– 11.30-23.30 CHECK BY ....

– 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING

CHECK BY เกรียงไกร

TIME	INGOT			RIDER	C/H	C/H	SCAP
20:15				252			
20:20	258						
20:30	260						
20:40				252			
20:50							67
21:00	276						
21:15	252						
21:30				252			
21:40	269						
21:50	279						
22:00				252			
22:20	238						
22:45	255						
23:10				252			
23:55	258						
01:10	239						
01:15				252			
01:20	250						
01:30	251						
02:25				252			
02:30	258						
02:35	255						
02:50				251			
03:15							192.5
03:30							192.5
TOTAL	4881 KG	KG	KG	1764 KG	KG	KG	452 KG
WEIGHT	7097 KG.						

MELTING DAILY REPORT

DATE 9/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							299362
9:00							299387
10:00							299448
11:00							299551
12:00							299560
13:00							299633
14:00							299692
15:00							299766
16:00							299823
17:00							299850
18:00							299898
19:00							299905
20:00							299916
			TOTAL GAS USED (M)				554

FLUX FEED

TIME START	TIME STOP					FLUX BY

TABAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line........Ton Check By ....

- Stop Line........Ton Check By ....

N_2

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY ______

TIME	INGOT			RISER	C/H	C/H	SCRAP
01:10		247					
01:20		248					
01:30				252			
08:50		242					
09:05		252					
09:15				252			
09:30		252					
09:35		244					
09:55				252			
10:15		249					
10:20		248					
10:35		246					
10:45		246					
11:05				252			
11:20		243					
11:40				180			
13:40		248					
13:45		245					
14:00				252			
14:05		247					
14:15		245					
14:55				252			
15:20		246					
15:30		244					
15:50				196			
17:30		249					
17:35		249					
TOTAL	KG	5182 KG	KG	2109 KG	KG	KG	KG
WEIGHT	7282 KG.						

MELTING DAILY REPORT

DATE 9/1/49 SHIFT ✓ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							299916
9:00							299967
10:00							300036
11:00							300095
12:00							300149
13:00							300179
14:00							300248
15:00							300307
16:00							300350
17:00							300375
18:00							300393
19:00							300425
20:00							300468
			TOTALGAS USED (M^3)				552

FLUX FEED

TIME START	TIME STOP					FLUX BY

TADAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL Start Line.......Ton Check By...........

Stop Line.......Ton Check By...........

N

- 11.30-03.30 CHECKBY ....
- 18.00-06.00 CHECKBY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RISER	C/H	C/H	SCAP
20:10							35
20:25				252			
20:50		252					
21:10		254					
20:20		252					
20:35		243					
20:50		248					
22:10						155	
22:25		248					
22:40				252			
22:55		249					
23:10		252					
23:0				252			
23:50		246					
01:00		249					
01:15		245					
01:35		249					
01:55				252			
02:15		252					
02:30		247					
02:55		252					
03:15		246					
TOTAL	KG	4084 KG	KG	1260 KG	KG	155 KG	35 KG
WEIGHT	5405 KG .						

MELTING DAILY REPORT

DATE 10/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							300458
21:00							300522
22:00							300596
23:00							300658
0:00							300706
1:00							300735
2:00							300766
3:00							300839
4:00							300906
5:00							300960
6:00							301091
7:00							301001
8:00							301003
			TOTALGAS USED (M)				535

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line........Ton Check By............

- Stop Line........Ton Check By............

N_2

- 11.30-03.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY วสุรัตน์

TIME	INGOT			RIDER	C/H	C/H	SCAP
06:00		248					
06:30							245
06:40				252			
07:00		241					
07:30		239					
08:20		241					
08:30		235					
08:50				252			
09:10		237					
09:30		249					
09:40		240					
09:50				252			
10:10		251					
10:30		251					
10:40				252			
11:00		246					
11:20		247					
11:30				252			
11:50		249					
13:25		248					
13:30		248					
14:00				108			
14:10		246					
14:15		243					
14:20		251					
14:50				252			
15:20		252					
15:25		253					
15:35		245					
16:00		248					
16:05				252			
TOTAL	KG	5413 KG	KG	18[illegible]2 KG	KG	KG	245KG
WEIGHT	7530 KG						

MELTING DAILY REPORT

DATE 10/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							301003
21:00							301063
22:00							301123
23:00							301177
0:00							301228
1:00							301349
2:00							301336
3:00							301338
4:00							301384
5:00							301432
6:00							301473
7:00							301494
8:00							301546
			TOTAL GAS USED (M³)				543

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL Start Line........Ton Check By.............

Stop Line........Ton Check By.............

N₂

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RIDER	C/H	C/H	SCAP
20:15		249					
20:20							30
20:30		249					
20:45				152			
20:55		250					
21:10		247					
21:25		252					
21:40				252			
22:05		250					
22:25		250					
22:35				124			
23:00		249					
23:15		246					
23:20				252			
23:45		248					
00:05		248					
01:45				252			
02:05		252					
02:25		248					
02:50				252			
03:00		252					
03:25						248	
03:30		253					
TOTAL	KG	3994 KG	KG	1304 KG	KG	248 KG	30 KG
WEIGHT	5576 KG.						

MELTING DAILY REPORT

DATE 11/1/49 SHIFT ◯ WHITE ✓ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							301546
9:00							301607
10:00							301669
11:00							301741
12:00							301799
13:00							301818
14:00							301848
15:00							301899
16:00							301967
17:00							302016
18:00							302061
19:00							302064
20:00							302082
			TOTAL GAS USED ( )				536

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line.......Ton Check By...........

- Stop Line.......Ton Check By...........

N_2

- 11.30-03.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY วสุจิตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
06:40		251					
06:50		252					
07:05						252	
07:10							50
08:20							
08:30		252					
08:40		256					
08:50				232			
09:10		248					
09:20		249					
09:30				252			
09:40		242					
09:50		245					
10:10		254		63			
10:20		250					
11:00		243					
11:10				252			
11:20		243					
11:40		246					
13:40		244		83			
13:50				252			
14:00		247					
14:10		246					
14:30				252			
14:50		245					
15:00		246					
15:20				198			
15:40		248					
15:50		247					
18:00				252			
18:10		245					
18:20		245					
TOTAL	KG	5444 KG	KG	1836 KG	KG	252 KG	50 KG
WEIGHT	7582 KG.						

MELTING DAILY REPORT

DATE 11/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							302063
9:00							302132
10:00							302196
11:00							302268
12:00							302322
13:00							302367
14:00							302405
15:00							302474
16:00							302514
17:00							302572
18:00							302604
19:00							302634
20:00							302654
			TOTAL GAS USED (M³)				571

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line.......Ton Check By............

- Stop Line.......Ton Check By............

N_2

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RISER	C/H	C/H	SCAP
20:30		250					
20:35		248					
20:40		246					
20:55		242					
21:20				260			
21:25		257					
21:50		249					
22:10				252			
22:15		249					
22:50		237					
23:15		241					
23:25		259					
23:50				252			
01:20		250					
01:30		249					
01:45				252			
02:00		237					
02:15		246					
02:25				252			
02:40		247					
02:50		243					
03:15				252			
03:30		246					
03:45		246					
TOTAL	KG	4310 KG	KG	1520 KG	KG	KG	KG
WEIGHT	5830 KG.						

MELTING DAILY REPORT

DATE 12/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							302654
21:00							302679
22:00							302704
23:00							302755
0:00							302833
1:00							302915
2:00							302969
3:00							302999
4:00							302076
5:00							303130
6:00							303154
7:00							303169
8:00							303174
			TOTAL GAS USED (M)				520

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line.......Ton Check By............

- Stop Line.......Ton Check By............

N

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING

CHECK BY วสุจิตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
08:40							50
09:00		252					
09:55		251					
10:00				252			
10:05		245					
10:35		247					
10:40				252			
10:50		248					
10:55		244					
11:10				252			
11:30		254					
11:40		251					
11:50				252			
11:55		249					
12:00		237					
12:50		253					
13:25				252			
13:40		237					
13:45		254					
14:20				252			
14:25		255					
14:50		254					
15:20				145			
15:35		248					
15:50		251					
TOTAL	KG	4241 KG	KG	1657 KG	KG	KG	50 KG
WEIGHT	5948 KG.						

MELTING DAILY REPORT

DATE 12/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							303174
21:00							303237
22:00							303306
23:00							303359
0:00							303416
1:00							303451
2:00							303511
3:00							303576
4:00							303607
5:00							303642
6:00							303670
7:00							3037 12
8:00							3037 40
			TOTAL GAS USED (M)				566

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line........Time Check By.............

- Stop Line........Time Check By............

N_2

- 11.30-23.30 CHECK BY ....
- 18.00-05.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RDER	C/H	C/H	SCAP
20;15							50
20:20				252			
20;30		246					
20;40		240					
20;50				252			
21:00		246					
21;15		244					
21;30				252			
21:40		245					
21;50		249					
22:00						232	
22:20		244					
22;45		250					
23;10				252			
23;55		256					
01;10		250					
01;15				252			
01;20		252					
01;30		247					
02;25		249					
02;30		248					
02;35				252			
02;50	243						
03;15	256						
03;30				252			
TOTAL	499 KG	3466 KG	KG	1764 KG	KG	232 KG	50 KG
WEIGHT	6011 KG.						

MELTING DAILY REPORT

DATE 13/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							303740
9:00							303750
10:00							303792
11:00							303850
12:00							303940
13:00							303960
14:00							304010
15:00							304045
16:00							304105
17:00							304148
18:00							304171
19:00							304207
20:00							304220
			TOTAL GAS USED (M)				480

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line........Ton Check By............

- Stop Line........Ton Check By............

N

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY วสุรัตน์

TIME	INGOT			RISER	C/H	C/R	SCAP
06:00							30
06:15	247						
06:30				252			
06:40	251						
06:20	257						
09:40				252			
09:50	276						
10:00	274						
10:10				252			
10:20	246						
10:30	254						
11:00				252			
11:05	275						
11:25	255						
11:40				252			
11:50	254						
14:00	249						
14:10				252			
14:20	254						
14:40	249						
14:50				252			
15:00	256						
15:15	250						
15:25				252			
16:00	262						
16:35	250						
17:00				252			
TOTAL	3878 KG	KG	2016 KG	KG	KG	KG	30 KG
WEIGHT	5824 KG.						

MELTING DAILY REPORT

DATE 13/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							304220
9:00							304261
10:00							304308
11:00							304377
12:00							304425
13:00							304450
14:00							304501
15:00							304575
16:00							304616
17:00							304651
18:00							304669
19:00							304681
20:00							304699
			TOTAL GAS USED				479

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line.......Ton Check By............

- Stop Line.......Ton Check By............

N_2

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RISER	C/H	C/H	SCAP
19:00							50
19:05	255						
21:00	266						
21:30	261						
21:40				252			
21:50	247						
22:00	257						
22:10					90		
22:20	253						
22:30	258						
22:45				252			
23:10	243						
23:30	255						
01:20				252			
01:25	258						
01:35	253						
01:50				252			
02:10	248						
02:15	258						
02:27				252			
02:45	261						
03:10	255						
TOTAL	2853 KG	KG	KG	1260 KG	90 KG	KG	50 KG
WEIGHT	5253 KG.						

MELTING DAILY REPORT

DATE 14/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							304699
21:00							304720
22:00							304731
23:00							304747
0:00							304764
1:00							304781
2:00							304796
3:00							304814
4:00							304831
5:00							304845
6:00							304858
7:00							304877
8:00							304899
			TOTALGAS USED (M)				200

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line........Ton Check By............

\- Stop Line........Ton Check By............

N_2

\- 11.30-23.30 CHECK BY ....

\- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY วสุรัตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
08:30	281						
08:50				252			
09:05				252			
09:20	249						
09:35	265						
09:50				252			
10:05	251						
10:25	250						
10:55				252			
11:15	254						
11:35	258						
11:50				252			
12:45	253						
12:55	236						
13:05	279						
13:30	251						
14:05				252			
14:30	251						
14:45	254						
15:20				252			
15:50	265						
16:10	257						
TOTAL	3958 KG	KG	KG	1764 KG	KG	KG	KG
WEIGHT	5873 KG.						

MELTING DAILY REPORT

DATE 14/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							304899
21:00							304920
22:00							304933
23:00							304948
0:00							304961
1:00							304972
2:00							304984
3:00							304996
4:00							305018
5:00							305029
6:00							305004
7:00							305071
8:00							305090
			TOTAL GAS USED (M)				180

FLUX FEED

TIME START	TIME STOP					FLUX BY

TABAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
PD		
Sn		
Cr		
Ca		

AL – Start Line.......Ton Check By............

– Stop Line.......Ton Check By............

N

- 11.30-23.30 CHECK BY ....
- 18.00-05.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING

CHECK BY เกรียงไกร

TIME	INGOT			RIDER	C/H	C/H	SCAP
21:15		254					
21:25		253					
21:35		244					
21:55		252					
22:15				252			
22:30		247					
22:45		251					
22:55				252			
23:10		248					
23:15		247					
23:25				252			
23:50		251					
01:25		246					
01:35				252			
01:40		250					
02:15		249					
02:25				252			
02:35		244					
02:55		246					
03:15				252			
03:30		246					
TOTAL	KG	4945 KG	KG	1764 KG	KG	KG	KG
WEIGHT	6749						

MELTING DAILY REPORT

DATE 15/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☐ AL-DC3 ☑

TEMPERATURE RECORD

TIME							
8:00							304699
9:00							304720
10:00							304731
11:00							304747
12:00							304764
13:00							304781
14:00							304796
15:00							304814
16:00							304831
17:00							304845
18:00							304858
19:00							304877
20:00							304899
			TOTAL GAS USED (M³)				200

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Cu		
Cr		
Ca		

AL - Start Line.......Ton Check By ....

- Stop Line.......Ton Check By ....

N_2

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY วสุรัตน์

TIME	INGOT			RISER	C/H	C/H	SCRAP
01:10		247					
01:20		248					
01:30				252			
06:50		242					
09:05		252					
09:15				252			
09:30		252					
09:35		244					
09:55				252			
10:15		249					
10:20		248					
10:35		246					
10:45		246					
11:05				252			
11:20		243					
11:40				180			
13:40		248					
13:45		245					
14:00				252			
14:05		247					
14:15		245					
14:55				252			
15:20		246					
15:30		244					
15:50				198			
17:30		249					
17:35		249					
TOTAL	KG	5182 KG	KG	2109 KG	KG	KG	KG
WEIGHT	7512 KG.						

MELTING DAILY REPORT

DATE 15/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							305237
9:00							305248
10:00							305357
11:00							305408
12:00							305416
13:00							305427
14:00							305439
15:00							305448
16:00							305458
17:00							305469
18:00							305481
19:00							305492
20:00							305508
			TOTAL GAS USED ( )				271

FLUX FEED

TIME START	TIME STOP					FLUX BY

TANAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL – Start Line.......Ton Check By............

– Stop Line.......Ton Check By............

N

– 11.30 -23.30 CHECK BY ....

– 16.00 -06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RISER	C/H	C/H	OCAP
20:15							50
20:20		215					
20:30				252			
20:40		242					
20:50		250					
21:00		248					
21:15		254					
21:30							
21:45				252			
22:00		246					
22:30		248					
22:40				252			
23:20		243					
23:35		251					
01:15				252			
01:20		253					
01:40		294					
01:50				252			
02:55		247					
02:30		241					
03:10				252			
03:15		244					
05:45		244					
05:55				252			
07:05		256					
07:15		255					
07:30		245					
TOTAL	KG	4477 KG	KG	1764 KG	KG	KG	50 KG
WEIGHT	6491 KG.						

MELTING DAILY REPORT

DATE 16/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							305508
21:00							305519
22:00							305555
23:00							305621
0:00							305671
1:00							305705
2:00							305762
3:00							305805
4:00							305887
5:00							305940
6:00							305966
7:00							306010
8:00							306059
			TOTAL GAS USED ( )				551

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL – Start Line.......Ton Check By............

– Stop Line.......Ton Check By............

N,

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY วสุรัตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
09:40	259						
09:50	255						
10:00				252			
10:30	246						
10:40	255						
11:20				252			
11:30	242						
12:50	259						
13:10				252			
13:25	271						
13:35	253						
14:20				252			
14:30	271						
15:00	277						
15:25				252			
15:40	262						
15:55	307						
16:10				252			
16:20	276						
16:30	251						
17:00				252			
TOTAL	3704 KG	KG	KG	1764 KG	KG	KG	KG
WEIGHT	5468 KG.						

MELTING DAILY REPORT

DATE 16/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							306059
21:00							306109
22:00							306159
23:00							306201
0:00							306326
1:00							306365
2:00							306422
3:00							306401
4:00							306481
5:00							306527
6:00							306587
7:00							306631
8:00							306687
			TOTAL GAS USED (M)				628

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line ....Ton Check By ....

\- Stop Line ....Ton Check By ....

N

\- 11.30-23.30 CHECK BY ....

\- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING

CHECK BY เกรียงไกร

TIME	INGOT			RISER	C/H	C/H	SCAP
18:30				252			
18:40	258						
18:45	250						
18:55				252			
20:15							50
20:20	276						
20:25	252						
20:50				252			
21:35	259						
21:55	279						
22:25				252			
22:35	238						
22:40	255						
22:45				252			
22:55	258						
23:25	239						
23:20				252			
23:55	250						
00:40	251						
01:10				252			
01:15	258						
01:20	255						
01:25				251			
02:10	251						
02:15	248						
02:30				252			
03:00	253						
03:30				250			
03:45	252						
04:00	250						
04:20				252			
05:00	244						
05:10	273						
05:20				252			
TOTAL	5957 KG	KG	KG	2722 KG	KG	KG	50 KG
WEIGHT	8179 KG.						

MELTING DAILY REPORT

DATE 17/1/49 SHIFT ◯ WHITE ✓ YELLOW ✓ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

MATERIAL CHARGING CHECK BY วสุรัตน์

TIME	INGOT			RIDER	C/H	C/H	SCAP
08:30	281						
08:50				252			
09:05				252			
09:30	249						
09:35	265						
09:50				252			
10:05	251						
10:25	260						
10:55				252			
11:15	264						
11:35	258						
11:50				252			
12:15	253						
12:55	236						
13:05	279						
13:30	261						
14:05				252			
14:30	251						
14:45	254						
15:20				252			
15:50	265						
16:10	257						
16:30				252			
17:00	256						
17:15	262						
17:40				252			
TOTAL	4382 KG	KG	KG	2268 KG	KG	KG	KG
WEIGHT	6650 KG.						

TEMPERATURE RECORD

TIME							
8:00							306657
9:00							306740
10:00							306795
11:00							306852
12:00							306903
13:00							306956
14:00							307013
15:00							307059
16:00							307105
17:00							307163
18:00							307201
19:00							307254
20:00							307651
			TOTAL GAS USED ( )				994

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line........Ton Check By............

\- Stop Line.......Ton Check By............

N

\- 11.30-23.30 CHECK BY............................

\- 18.00-06.00 CHECK BY............................

FILTER ☐ ☐

REMARK

MELTING DAILY REPORT

DATE 17/1/49 SHIFT ✓ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							307281
9:00							307322
10:00							307396
11:00							307453
12:00							307490
13:00							307556
14:00							307589
15:00							307646
16:00							307704
17:00							307755
18:00							307777
19:00							307851
20:00							307901
			TOTAL GAS USED (m^3)				620

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT			
Cu			
Si			
Mg			
Zn			
Fe			
Mn			
Ni			
Ti			
Pb			
Sn			
Cr			
Ca			

AL - Start Line........Ton Check By............

- Stop Line........Ton Check By............

N

- 11.30 -23.30 CHECK BY ....
- 18.00 -06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RISER	C/H	C/H	SCAP
20:10	216						
20:20	257						
20:30				252			
20:50	252						
21:30	252						
21:40				252			
21:50	257						
22:30				252			
23:00	247						
23:30				252			
23:50	258						
23:55	270						
01:25				252			
01:35	254						
01:50	254						
02:50				252			
03:15	257						
03:40	251						
03:50				252			
04:35	257						
04:50	253						
05:00				252			
06:40	259						
06:45	254						
06:50				252			
07:10	253						
07:30	270						
07:40				295			
07:45	259						
07:55	261						
TOTAL	5111 KG	KG	KG	2563 KG	KG	KG	KG
WEIGHT	7674 KG.						

MELTING DAILY REPORT

DATE 18/1/49 SHIFT ◯ WHITE ☑ YELLOW

☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							307901
21:00							307972
22:00							308037
23:00							308090
0:00							308180
1:00							308187
2:00							308233
3:00							308301
4:00							308373
5:00							308408
6:00							308452
7:00							308476
8:00							308520
			TOTAL GAS USED (M)				619

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line........Ton Check By............

- Stop Line........Ton Check By............

N

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING

CHECK BY วสุรัตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
08:10	261						
08:20	255						
08:25	259						
09:05				252			
09:25	254						
09:40	255						
10:00				252			
10:35	265						
10:50	247						
11:20				252			
11:30	243						
11:50	258						
12:45	270						
12:55	268						
13:15				252			
14:00	271						
14:45	250						
15:25				252			
16:00	251						
16:45	261						
16:50	245						
18:00	240						
18:15	274						
18:30	272						
TOTAL	4919 KG	KG	KG	1260 KG	KG	KG	KG
WEIGHT	6179 KG.						

MELTING DAILY REPORT

DATE 18/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							308520
21:00							308506
22:00							308652
23:00							308724
0:00							308754
1:00							308781
2:00							308831
3:00							308896
4:00							308908
5:00							308975
6:00							308968
7:00							308993
8:00							308008
			TOTALGAS USED (M³)				488

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT		
Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL - Start Line.......Ton Check By............

- Stop Line.......Ton Check By............

N

- 11.30-23.30 CHECK BY ....
- 18.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING

CHECK BY เกรียงไกร

TIME	INGOT			RICER	C/H	C/H	SCAP
20;15	258						
20;20	260						
20;30				252			
21;20	258						
21;30	244						
21;40				252			
22;20	237						
22;30	257						
22;40				252			
23;00	254						
23;10	243						
23;30				252			
01;20	245						
01;30	264						
01;50				252			
02;10	259						
02;20				252			
02;40	280						
02;50				252			
03;20	269						
03;30				252			
TOTAL	3348 KG	KG	KG	2016 KG	KG	KG	KG
WEIGHT	5394 KG.						

MELTING DAILY REPORT

DATE 19/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							309008
9:00							309060
10:00							309140
11:00							309200
12:00							309274
13:00							309314
14:00							309363
15:00							309415
16:00							309473
17:00							309491
18:00							309508
19:00							309555
20:00							309594
			TOTALGAS USED (M³)				586

FLUX FEED

TIME START	TIME STOP					FLUX BY

TABAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

AL – Start Line.......Ton Check By...........

– Stop Line.......Ton Check By...........

N

– 11.30-23.30 CHECKBY ....

– 18.00-06.00 CHECKBY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING

CHECK BY วสุรัตน์

TIME	INGOT			RISER	C/H	C/H	SCAP
08:00							63
08:10	245						
08:25	254						
08:45				252			
09:00	235						
09:15	265						
09:30				252			
09:45	237						
10:00	263						
10:15				252			
10:30	270						
10:50	252						
11:05				252			
11:25	253						
11:40	254						
12:00				252			
13:25	254						
13:40	250						
13:55				252			
14:20	253						
14:40	247						
14:55				252			
15:30	237						
TOTAL	3851 KG	KG	KG	1764 KG	KG	KG	KG
WEIGHT	5678 KG.						

MELTING DAILY REPORT

DATE 19/1/49 SHIFT ☑ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
8:00							309594
9:00							309643
10:00							309698
11:00							309763
12:00							309846
13:00							309858
14:00							309886
15:00							309942
16:00							310004
17:00							310059
18:00							310098
19:00							310108
20:00							310132
			TOTAL GAS USED (M³)				539

FLUX FEED

TIME START	TIME STOP					FLUX BY

TAMAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

Cu		
Si		
Mg		
Zn		
Fe		
Mn		
Ni		
Ti		
Pb		
Sn		
Cr		
Ca		

[illegible] AL – [illegible] Start Line.......Ton Check By ....

– [illegible] Stop Line.......Ton Check By ....

[illegible] N

– 11:30-23:30 CHECK BY ....

– 18:00-06:00 CHECK BY ....

FILTER [illegible] ☐ [illegible] ☐ [illegible]

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RISER	C/H	C/H	SCAP
18:10					49		
18:20							50
18:30	257						
18:50	254						
19:00				252			
20:10	258						
20:25	256						
20:30	253						
21:00	245						
21:15				153			
21:20	254						
21:35	247						
21:45				252			
22:15	253						
22:25	246						
22:40				252			
23:05	255						
23:10	270						
23:20	254						
23:40				252			
21:30	253						
01:35	253						
01:40				252			
01:50	253						
02:30				252			
03:10	293						
03:20				252			
03:50	256						
03:55				252			
04:15	258						
04:30				252			
04:45	248						
TOTAL	4979 KG	KG	KG	2169KG	49KG	KG	50KG
WEIGHT	7238						

MELTING DAILY REPORT

DATE 20/1/49 SHIFT ◯ WHITE ☑ YELLOW ☑ DAY ☐ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							310132
21:00							310160
22:00							310182
23:00							310226
0:00							310259
1:00							310286
2:00							310346
3:00							310427
4:00							310480
5:00							310507
6:00							310544
7:00							310553
8:00							310588
			TOTAL GAS USED (B)				456

FLUX FEED

TIME START	TIME STOP					FLUX BY

TABAGO CUP		
8:00	20:00	
9:00	21:00	
10:00	22:00	
11:00	23:00	
12:00	0:00	
13:00	1:00	
14:00	2:00	
15:00	3:00	
16:00	4:00	
17:00	5:00	
18:00	6:00	
19:00	7:00	

ELEMENT			
Cu			
Si			
Mg			
Zn			
Fe			
Mn			
Ni			
Ti			
Pb			
Sn			
Cr			
Ca			

AL – Start Line.......Ton Check By...........

– Stop Line.......Ton Check By............

N

– 11.30-23.30 CHECK BY ....

– 16.00-06.00 CHECK BY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY วสุทัตน์

TIME	INGOT			RICEP	C/H	C/H	SCAP
06:50	274						
07:20	246						
08:50	248						
10:15							30
10:25	242						
10:40				252			
11:15	246						
11:30	242						
11:55				252			
13:15	247						
13:50	251						
14:10				252			
14:25	241						
14:45	254						
15:00				252			
15:15	249						
15:30	254						
15:45				252			
TOTAL	2984 KG	KG	KG	1260 KG	KG	KG	30 KG
WEIGHT	4274 KG.						

MELTING DAILY REPORT

DATE 20/1/49 SHIFT ✓ WHITE ◯ YELLOW ☐ DAY ☑ NIGHT ☐ AL-DC1 ☐ AL-DC2 ☑ AL-DC3

TEMPERATURE RECORD

TIME							
20:00							310558
21:00							310605
22:00							310673
23:00							310742
0:00							310795
1:00							310810
2:00							310841
3:00							310921
4:00							310971
5:00							311010
6:00							311061
7:00							311086
8:00							311112
			TOTALGAS USED (M)				524

FLUX FEED

TIME START	TIME STOP					FLUX BY

TANAGO CUP						
8:00	20:00			Cu		
9:00	21:00			Si		
10:00	22:00			Mg		
11:00	23:00			Zn		
12:00	0:00			Fe		
13:00	1:00			Mn		
14:00	2:00			Ni		
15:00	3:00			Ti		
16:00	4:00			Pb		
17:00	5:00			Sn		
18:00	6:00			Cr		
19:00	7:00			Ca		

AL – Start Line.......Ton Check By............

– Stop Line.......Ton Check By............

N

– 11.30-23.30 CHECKBY ....

– 18.00-06.00 CHECKBY ....

FILTER ☐ ☐

REMARK

MATERIAL CHARGING CHECK BY เกรียงไกร

TIME	INGOT			RIDER	C/H	C/H	SCAP
18:40	254						
18:45	242						
20:40				196			
21:00	254						
21:30				198			
21:40	241						
21:50				117			
22:00	249						
22:10						248	
22:30	266						
22:50				216			
23:00	273						
23:10				252			
23:30	251						
23:50				252			
01:20	248						
01:30				252			
02:00	138						
02:10				252			
02:20	237						
02:30				252			
02:50	265						
03:00				252			
03:40	242						
04:00	272						
04:10				252			
04:30	262						
04:40	271						
TOTAL	3975 KG	KG	KG	2493 KG	KG	248 KG	KG
WEIGHT	6716						

ภาคผนวก จ.

ลำดับสัญลักษณ์

Nomenclature

1J	=	2.3885×10^{-4} kcal	=	Energy
3600s	=	1 hr	=	Time

a	Molar oxygen-fuel (kmol/kmol)
A/F	Mass air-fuel ratio (kg/kg)
$c_p, \overline{c_p}$	Constant-pressure specific heat (J/kg-K or J/kmol-K)
$c_v, \overline{c_v}$	Constant-volume specific heat (J/kg-K or J/kmol-K)
F/A	Mass fuel-air ratio (kg/kg)
$h^{\circ}{}_f, \overline{h^{\circ}}{}_f$	Enthalpy of formation (J/kg or J/kmol)
$H, h, \overline{h}$	Enthalpy (J or J/kg or J/kmol)
$\Delta H_c, \Delta h_c, \Delta \overline{h}_c$	Heat of combustion (Heating value) (J or J/kg or J/kmol)
$\Delta H_R, \Delta h_R, \Delta \overline{h}_R$	Enthalpy of reaction (J or J/kg or J/kmol) =
HHV	Higher heating value (J/kg)
LHV	Lower heating value (J/kg)
m	Mass (kg)
$\dot{m}$	Mass flow rate (kg/s)
MW	Molecular weight (kg/kmol)
N	Number of moles (kmol)
P	Pressure (Pa)
Q, q	Heat (J or kJ)
$\dot{Q}, \dot{q}$	Heat transfer rate (J/s = W or W/kg)
R	Specific gas constant (J/kg-K)
R_u	Universal gas constant (J/kmol-K)
T	Temperature (K)
v	Velocity (m/s)
V, υ	Volume (m^3 or m^3/kg)
x	Number of carbon atom in fuel

y	Number of hydrogen atom in fuel
Y	Mass fraction (kg/kg)

Greek Symbols

Φ	Equivalence ratio
ρ	Density (kg/m^3)
χ	Mole fraction

Subscribts

ad	Adiabatic
A	Air
cv	Control volume
f	Final of formation
F	Fuel
g	Gas
i	i th species or inlet
init	Innitial
l	Liquid
mix	Mixture
o	Outlet
prod	Product
reac	Reactant
ref	Reference
s	Sensible
sat	Saturation state
stoic	Stoichiometric
T	At temperature T