APPENDIX TWO

Table Ap.1

Errors evaluation of thermal diffusivity coefficient determination with measuring tubes of the first type (tube No.1, $\ell_h = 400mm$).

Results of experiments with water, $T_e \approx 30$ °C, $a = 1.48 \cdot 10^{-7}$ m²/s, $T_b \approx 20$ °C, $T_w \approx 40$ °C.

No.	$g \cdot 10^6$, m^3/sec	$\bar{\theta}$	$\tilde{z} \cdot 10^{-5}$	$\ln \bar{\theta}$	$\bar{z}$	$a \cdot 10^7$, m^2/sec
1	2.720	0.653	1.47	-0.426	0.0305	1.322
2	1.905	0.601	2.09	-0.511	0.0455	1.380
3	1.376	0.513	2.90	-0.667	0.0655	1.434
4	1.178	0.487	3.39	-0.717	0.0720	1.351
5	0.921	0.390	4.33	-0.941	0.1020	1.495
6	1.066	0.468	3.74	-0.759	0.0775	1.315
7	1.150	0.483	3.48	-0.727	0.0735	1.346
8	1.375	0.526	2.89	-0.642	0.0620	1.358
9	1.653	0.553	2.42	-0.591	0.0560	1.474
10	1.775	0.572	2.24	-0.558	0.0515	1.456
11	1.910	0.581	2.09	-0.543	0.0495	1.507
12	1.660	0.551	2.41	-0.594	0.0560	1.483
13	1.150	0.477	3.48	-0.738	0.0750	1.373
14	0.904	0.396	4.43	-0.925	0.0995	1.432
15	0.748	0.355	5.34	-1.035	0.1150	1.371
16	1.052	0.443	3.81	-0.812	0.0840	1.407
17	1.273	0.496	3.15	-0.699	0.0600	1.426
18	1.502	0.536	2.67	-0.624	0.0624	1.441
19	1.589	0.546	2.52	-0.603	0.0525	1.504
20	1.870	0.572	2.14	-0.657	0.0695	1.407
$\bar{a} \approx 1.42 \cdot 10^{-7}$ m²/sec, $\delta \approx 4.1\%$, $\bar{\delta} \approx 2\%$, $\varepsilon \approx -4.05\%$, $\Sigma \approx 13\%$						

Table Ap.2

Errors evaluation of thermal diffusivity coefficient determination with measuring tubes of the first type (tube No.3, ℓ_h = 700mm).

Results of experiments with water, $T_e \approx 30$ °C, $a = 1.48 \cdot 10^{-7}$ m^2/s, $T_b \approx 25$ °C, $T_w \approx 35$ °C.

No.	$g \cdot 10^6$, m^3/sec	$\bar{\theta}$	$\tilde{z} \cdot 10^{-5}$	$\ln \bar{\theta}$	$\bar{z}$	$a \cdot 10^7$, m^2/sec
1	2.640	0.542	2.65	-0.611	0.0585	1.408
2	1.850	0.434	3.79	-0.832	0.0875	1.477
3	1.920	0.469	3.65	-0.754	0.0770	1.347
4	0.809	0.217	8.66	-1.530	0.1820	1.340
5	0.756	0.191	9.26	-1.660	0.1990	1.370
6	1.626	0.410	4.32	-0.890	0.0950	1.403
7	1.790	0.432	3.91	-0.838	0.0880	1.440
8	1.770	0.436	3.96	--0.831	0.0870	1.403
9	1.880	0.439	3.41	-0.823	0.0860	1.470
10	2.050	0.443	5.51	-0.812	0.0845	1.575
11	1.270	0.311	3.72	-1.166	0.1325	1.530
12	2.360	0.508	2.97	-0.676	0.0650	1.428
13	3.720	0.602	1.88	-0.506	0.0450	1.523
14	2.840	0.567	2.47	-0.566	0.0525	1.356
15	2.510	0.515	2.49	-0.662	0.0650	1.480
16	11.910	0.445	3.68	-0.810	0.0840	1.460
17	1.380	0.370	5.07	-0.994	0.1090	1.368
18	2.097	0.492	3.33	-0.708	0.0710	1.354
19	2.730	0.545	2.56	-0.607	0.0575	1.428
20	3.299	0.587	2.12	-0.534	0.0485	1.455
$\bar{a} \approx 1.43 \cdot 10^{-7}$ m^2/sec, $\delta \approx 4.5\%$, $\bar{\delta} \approx 2.1\%$ $\varepsilon \approx -3.3\%$, $\Sigma \approx 12\%$						

Table Ap.3

Errors evaluation of thermal diffusivity coefficient determination with measuring tubes of the first type (tube N 3 $\ell_T = 700\,mm$)

Results of experiments with toluene, $T_e \approx 36$ °C, $a = 0.883 \cdot 10^{-7}$ m^2/s, $T_b \approx 31$ °C, $T_w \approx 41$ °C.

No.	$g \cdot 10^6$, m^3/sec	$\ln \bar{\theta}$	$\bar{z}$	$a \cdot 10^7$, m^2/sec
1	1.47	-0.285	0.06400	0.856
2	1.45	-0.286	0.06425	0.847
3	1.44	-0.290	0.06550	0.858
4	1.48	-0.286	0.06425	0.865
5	1.49	-0.278	0.06220	0.843
6	1.47	-0.288	0.06500	0.869
7	1.43	-0.292	0.06600	0.858
8	1.40	-0.290	0.06550	0.834
9	1.40	-0.292	0.06600	0.840
10	1.43	-0.294	0.06720	0.875
11	1.44	-0.290	0.06550	0.880
12	1.43	-0.289	0.06725	0.852
13	1.41	-02.94	0.06725	0.862
14	1.40	-0.294	0.06750	0.856
15	1.42	-0.297	0.06725	0.872
16	1.43	-0.294	0.06762	0.875
17	1.44	-0.293	0.06720	0.800
18	1.43	-0.293	0.06720	0.874
19	1.40	-0.288	0.06500	0.828
20	1.43	-0.292	0.06600	0.858
$\bar{a} \approx 0.8504 \cdot 10^{-7}$ m^2/sec, $\delta \approx 2.35\%$, $\bar{\delta} \approx 1.01\%$, $\varepsilon \approx -3.7\%$, $\Sigma \approx 8.6\%$				

Table Ap.4

Errors evaluation of thermal diffusivity coefficient determination with measuring tubes of the first type (tube No.3, $\ell_h = 700\,\text{mm}$).

Results of experiments with glycerin, $T_e \approx 35\ °C$, $a = 0.924 \cdot 10^{-7}\ m^2/s$, $T_b \approx 31\ °C$, $T_w \approx 39.5\ °C$.

No.	$g \cdot 10^6$, m^3/sec	$\ln \bar{\theta}$	$\bar{z}$	$a \cdot 10^7$, m^2/sec
1	1.025	-0.4059	0.1010	0.9415
2	1.027	-0.4142	0.1035	0.967
3	1.009	-0.4186	0.1050	0.964
4	1.035	-0.4237	0.1065	1.002
5	1.002	-0.4258	0.1070	0.975
6	0.998	-0.4315	0.1090	0.989
7	0.962	-0.4329	0.1059	0.958
8	0.963	-0.4319	0.1090	0.955
9	0.977	-0.4343	0.10975	0.976
10	0.945	-0.4349	0.1100	0.945
11	0.946	-0.4393	0.1115	0.959
12	0.967	-0.4426	0.1125	0.9893
13	0.959	-0.4466	0.1140	0.994
14	0.946	-0.4473	0.1140	0.981
15	0.936	-0.4455	0.1135	0.965
16	0.937	-0.4480	0.1140	0.971
17	0.945	-0.4449	0.1130	0.971
18	0.923	-0.4472	0.1140	0.957
$\bar{a} \approx 0.9711 \cdot 10^{-7}\ m^2/sec$, $\delta \approx 1.6\%$, $\bar{\delta} \approx 0.8\%$, $\varepsilon \approx 5.1\%$, $\sum \approx 8.5\%$				

Table Ap.5

Errors evaluation of thermal diffusivity coefficient determination in case of use of two measuring tubes of the first type connected in series
Results of experiments with water, $T_e \approx 30$ °C, $a = 1.48 \cdot 10^{-7}$ m²/s, $T_b \approx 20$ °C, $T_w \approx 40$ °C.

No.	$g \cdot 10^6$, m^3/s	$\bar{\theta}_1$	$\bar{\theta}_2$	$\tilde{z}_1 \cdot 10^{-5}$	$\tilde{z}_2 \cdot 10^{-5}$	$\ln \bar{\theta}_1$	$\ln \bar{\theta}_2$	$a \cdot 10^7$, m^2/s
1	4.140	0.671	0.735	1.57	0.966	-0.398	-0.308	1.37
2	2.630	0.590	0.664	2.48	1.52	-0.529	-0.409	1.17
3	2.280	0.541	0.626	2.85	1.75	-0.614	-0.467	1.23
4	1.424	0.419	0.527	4.57	2.81	-0.869	-0.640	1.19
5	1.210	0.378	0.486	5.37	3.30	-0.973	-0.720	1.15
6	0.958	0.316	0.426	6.78	4.17	-1.152	-0.853	1.09
7	0.769	0.239	0.355	8.47	5.20	-1.428	-1.035	1.115
8	1.040	0.331	0.441	6.25	3.84	-1.108	-0.818	1.105
9	1.144	0.366	0.474	5.70	3.51	-1.070	-0.746	1.37
10	1.616	0.464	0.558	4.02	2.47	-0.768	-0.583	1.15
$\bar{a} \approx 1.2 \cdot 10^{-7}$ m²/sec, $a_1 \approx 1.39 \cdot 10^{-7}$ m²/sec, $a_2 \approx 1.47 \cdot 10^{-7}$ m²/sec, $m_1 = 1.6 \cdot 10^{-6}$, $m_2 = 1.6 \cdot 10^{-6}$, $\varepsilon \approx 19\%$, $\delta \approx 8.4\%$								

Table Ap.6

Errors evaluation of TPP determination with measuring tubes of the second type (tube No.1, $\ell_h = 1680$ mm)

Results of experiments with water, $T_e \approx 35$ °C, $a = 1.5 \cdot 10^{-7}$ m^2/s, $\lambda = 0.62$ W/(m·grad) $T_b \approx 25$ °C, $T_w \approx 30 \ldots 40$ °C.

No.	$g \cdot 10^6$, m^3/sec	$(T_e - T_b)$, °C	$T(R, \ell_h)-T_e$, °C	λ W/(m·°C)	$a \cdot 10^7$, m^2/sec
1	3.52	1.87	1.61	0.625	1.49
2	2.38	2.51	1.97	0.553	1.32
3	1.29	4.48	1.79	0.589	1.40
4	1.32	4.21	1.61	0.633	1.50
5	1.53	4.48	2.24	0.563	1.33
6	1.53	4.93	2.24	0.614	1.46
7	1.06	14.00	4.62	0.567	1.39
8	1.07	9.25	3.25	0.553	1.33
9	1.08	10.10	3.25	0.622	1.49
10	1.41	10.10	4.17	0.630	1.50
11	1.42	8.30	3.70	0.577	1.24
12	1.67	6.47	3.25	0.625	1.44
13	1.38	8.30	3.70	0.566	1.34
14	1.16	8.30	2.77	0.635	1.50
15	1.01	18.50	5.53	0.650	1.47
16	0.90	12.00	3.25	0.605	1.44
17	1.10	10.60	3.70	0.555	1.38
18	0.94	10.20	3.25	0.543	1.29
19	1.07	10.10	3.70	0.537	1.28
20	0.92	11.50	3.70	0.525	1.24
	$\bar{a} = 1.39 \cdot 10^{-7}$ m^2/sec,			$\bar{\lambda} = 0.59$ W/(m·°C)	
	$\delta = 6\%$,			$\delta = 6.7\%$,	
	$\varepsilon = -7.3\%$,			$\varepsilon = -5\%$,	
	$\Sigma = 20\%$			$\Sigma = 18\%$	

Table Ap.7

Errors evaluation of liquids TPP determination with measuring tubes of the third type (tube No.1, ℓ_1=40 mm, L_1 = 140 mm, ℓ_2 = 300 mm, L_2 = 400 mm)
Results of experiments with water, $T_e \approx 30$ °C, $a = 1.48 \cdot 10^{-7}$ m²/s,
$\lambda = 0.616$ W/(m·grad), $T_b \approx 15$ °C, $T_w \approx 25 \ldots 35$ °C.

No.	$g \cdot 10^6$, m^3/s	q, W/m^2	T_1-T_b, °C	T_2-T_b, °C	Y_2	$a \cdot 10^7$, m^2/s	λ W/(m°C)
1	0.40		9.3	19.3	0.225	1.432	0.570
2	0.40		9.3	19.2	0.218	1.388	0.622
3	0.39		9.3	19.2	0.218	1.353	0.563
4	0.39		9.3	19.2	0.218	1.353	0.563
5	0.39		0.3	19.2	0.218	1.353	0.563
6	0.40		9.3	19.2	0.218	1.388	0.562
7	0.40		9.3	19.3	0.225	1.432	0.570
8	0.40		9.3	19.3	0.225	1.432	0.570
9	0.39		9.3	19.4	0.231	1.434	0.578
10	0.40		9.3	19.3	0.225	1.432	0.570
11	0.40	4450	9.3	19.3	0.225	1.432	0.570
12	0.39		9.3	19.3	0.225	1.397	0.571
13	0.39		9.3	19.4	0.231	1.434	0.578
14	0.40		9.3	19.3	0.225	1.432	0.570
15	0.41		9.2	19.2	0.233	1.520	0.578
16	0.41		9.2	19.2	0.233	1.520	0.587
17	0.41		9.2	19.2	0.233	1.520	0.587
18	0.40		9.3	19.3	0.225	1.432	0.570
19	0.40		9.3	19.3	0.225	1.432	0.570
20	0.41		9.3	19.2	0.233	1.520	0.587
δ_a=3.7%		δ_λ=1.5%		$\bar{a}$=1.432·10⁻⁷		$\bar{\lambda}$=0.5724	
$\bar{\delta}$=1.75%		$\bar{\delta}_\lambda$=0.7%		ε_a=-3.25%		ε_λ=-7.1%	
$\Sigma_a \approx 11\%$		$\Sigma_\lambda \approx 10\%$		a_t=1.48·10⁻⁷		λ_t=0.616	

Table Ap.8

Errors evaluation of specific heat capacity determination with measuring tubes of the fourth type

Results of experiments with water, $T_b \approx 30$ °C, c = 4180 J/(kg ··grad)

№	P,W	$g \cdot 10^6 \cdot m^3/s$	ΔT,°C	$c \cdot 10^{-3}$, J/(kg ··grad)
1		6.10	1.02	4.28
2		3.90	1.62	4.15
3		2.98	2.08	4.30
4	26.2	3.19	1.89	4.33
5		2.32	2.68	4.20
6		2.12	2.86	4.32
7		2.50	2.48	4.25
8		6.02	1.43	4.20
9		5.10	1.62	4.36
10		4.48	1.89	4.38
11	36.2	3.34	2.43	4.40
12		2.90	2.82	4.36
13		2.40	3.56	4.21
14		2.06	3.88	4.50
15		5.38	2.08	4.46
16		5.00	2.22	4.51
17	51.2	3.88	2.82	4.36
18		3.64	3.23	4.31
19		2.03	5.80	4.32
20		2.22	5.36	4.29
$\bar{c} = 4.32 \cdot 10^3$ J/(kg·grad), $\varepsilon = 3.3\%$, $\delta = 2.3\%$, $\Sigma = 9\%$ $\bar{\delta} = 1.1$ %				

Table Ap.9

Coefficients for Equations /2.3/, /2.4/ and /2.33/

n	ε_n	A_n	B_n	$\bar{A}_n$	$\hat{A}_n$	$\bar{z}_n^*$
1	2.704	1.476	0.749	2.095	-10.79	-
2	6.679	-0.806	0.544	-2.211	35.95	0.066
3	10.673	0.589	0.463	2.241	-57.06	0.051
4	14.671	-0.476	0.415	-	-	0.040
.	.	.	.	.	.	.
11	42.668	0.233	0.290	-	-	0.013

Table Ap.10

Coefficients for Equations /3.3/, /3.19/ and /3.33/

No.	ε_n	$\psi_n(1)$	A_n	$\bar{A}_n$	A_n^*	$\bar{z}_n^*$
1	5.068	-0.493	0.2017	-2.053	-10.36	0.147
2	9.158	0.396	-0.0876	2.130	14.68	0.061
3	14.198	-0.346	0.0528	-2.170	-18.37	0.044
7	29.255	-0.260	0.0178	-	-	0.0199

Table Ap.11

The results of experimental investigation of standard liquids TPP on measuring device of the fifth type (before corrections). Temperature of liquids T ≈ 26 °C

γ	No.	Water		Glycerin		Alcohol	
		$\lambda_{\text{тт}}$	$a_{\text{тт}}\cdot 10^7$	$\lambda_{\text{тт}}$	$a_{\text{тт}}\cdot 10^7$	$\lambda_{\text{тт}}$	$a_{\text{тт}}\cdot 10^7$
0	1	0.621	1.54	0.315	1.05	0.205	0.95
	2	0.622	1.66	0.311	1.06	0.216	0.96
	3	0.625	1.56	0.315	1.07	0.210	1.01
	4	0.623	1.58	0.314	1.01	0.214	1.01
	5	0.618	1.59	0.311	1.05	0.211	1.02
$\bar{\lambda}$, $\bar{a}$		0.622	1.586	0.313	1.048	0.211	0.99
10	1	0.620	1.68	0.312	0.98	0.209	0.96
	2	0.628	1.57	0.307	1.00	0.207	1.00
	3	0.615	1.56	0.315	1.01	0.204	1.01
	4	0.623	1.66	0.313	1.03	0.209	1.02
	5	0.623	1.65	0.314	1.02	0.206	1.04
$\bar{\lambda}$, $\bar{a}$		0.622	1.624	0.312	1.008	0.207	1.006
20	1	0.618	1.64	0.306	1.04	0.211	1.01
	2	0.617	1.62	0.306	1.01	0.212	1.00
	3	0.622	1.65	0.315	1.06	0.212	1.03
	4	0.629	1.55	0.314	1.02	0.214	0.94
	5	0.625	1.58	0.309	0.95	0.209	0.95
$\bar{\lambda}$, $\bar{a}$		0.622	1.608	0.310	1.016	0.212	0.986
30	1	0.624	1.60	0.307	1.00	0.207	1.00
	2	0.621	1.62	0.308	1.01	0.208	1.02
	3	0.624	1.66	0.310	1.04	0.211	1.03
	4	0.628	1.66	0.313	1.05	0.213	1.02
	5	0.627	1.66	0.310	1.08	0.211	0.98
$\bar{\lambda}$, $\bar{a}$		0.624	1.64	0.310	1.036	0.210	1.01

Table Ap.12

The results of experimental investigation of TPP standard liquids on measuring device of the fifth type (after corrections).

Temperature of liquids T ≈ 26 °C

Y	No.	Water		Glycerin		Alcohol	
		λ_{TT}	$a_{TT}\cdot 10^7$	λ_{TT}	$a_{TT}\cdot 10^7$	λ_{TT}	$a_{TT}\cdot 10^7$
0	1	0.591	1.36	0.285	0.91	0.185	0.85
	2	0.592	1.46	0.281	0.92	0.186	0.86
	3	0.595	1.46	0.285	0.90	0.180	0.81
	4	0.594	1.48	0.284	0.93	0.184	0.81
	5	0.591	1.49	0.281	0.94	0.181	0.92
$\bar{\lambda}$, $\bar{a}$		0.593	1.45	0.283	0.926	0.183	0.85
10	1	0.590	1.48	0.282	0.98	0.189	0.86
	2	0.596	1.47	0.287	0.98	0.187	0.91
	3	0.595	1.46	0.295	0.91	0.184	0.91
	4	0.593	1.46	0.293	0.93	0.189	0.92
	5	0.593	1.45	0.294	0.92	0.186	0.94
$\bar{\lambda}$, $\bar{a}$		0.593	1.464	0.290	0.944	0.187	0.908
20	1	0.598	1.44	0.286	0.94	0.181	0.90
	2	0.597	1.42	0.286	0.91	0.182	0.94
	3	0.592	1.45	0.285	0.96	0.182	0.96
	4	0.599	1.45	0.284	0.92	0.184	0.84
	5	0.595	1.48	0.289	0.95	0.189	0.85
$\bar{\lambda}$, $\bar{a}$		0.596	1.448	0.286	0.936	0.184	0.898
30	1	0.593	1.40	0.287	0.95	0.187	0.96
	2	0.592	1.42	0.288	0.95	0.188	0.95
	3	0.593	1.46	0.280	0.94	0.181	0.94
	4	0.592	1.46	0.283	0.95	0.183	0.95
	5	0.593	1.46	0.280	0.95	0.181	0.88
$\bar{\lambda}$, $\bar{a}$		0.593	1.44	0.286	0.953	0.184	0.936