

Tablas 4.4: Propiedades de gases a presión atmosférica

Tabla 4.4.1: Propiedades del aire seco a presión atmosférica

T (°C)	ρ (kg/m ³)	c_p (kJ/kg·K)	$\mu \cdot 10^6$ (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
-150	2.867	0.9825	8.636	3.013	11.71	4.157	0.7246
-100	2.039	0.9656	11.9	5.835	15.82	8.034	0.7263
-90	1.927	0.9753	12.49	6.482	16.62	8.842	0.733
-80	1.828	0.9835	13.07	7.153	17.42	9.692	0.7381
-70	1.738	0.9901	13.64	7.85	18.22	10.59	0.7414
-60	1.656	0.9952	14.2	8.572	19.01	11.53	0.7433
-50	1.582	0.999	14.74	9.317	19.79	12.52	0.744
-40	1.514	1.002	15.27	10.08	20.57	13.56	0.7436
-30	1.452	1.004	15.79	10.88	21.34	14.65	0.7425
-20	1.394	1.005	16.3	11.69	22.11	15.78	0.7408
-10	1.341	1.006	16.8	12.52	22.88	16.96	0.7387
0	1.292	1.006	17.29	13.38	23.64	18.17	0.7362
5	1.269	1.006	17.54	13.82	24.01	18.8	0.735
10	1.247	1.006	17.78	14.26	24.39	19.44	0.7336
15	1.225	1.007	18.02	14.71	24.76	20.08	0.7323
20	1.204	1.007	18.25	15.16	25.14	20.74	0.7309
25	1.184	1.007	18.49	15.61	25.51	21.4	0.7296
30	1.164	1.007	18.72	16.08	25.88	22.08	0.7282
35	1.146	1.007	18.95	16.54	26.25	22.76	0.7268
40	1.117	1.007	19.18	17.02	26.62	23.45	0.7255
45	1.11	1.007	19.41	17.49	26.99	24.16	0.7241
50	1.092	1.007	19.63	17.97	27.35	24.87	0.7228
55	1.076	1.007	19.86	18.46	27.72	25.59	0.7215
60	1.06	1.007	20.08	18.95	28.08	26.31	0.7202
65	1.044	1.007	20.3	19.45	28.45	27.05	0.719
70	1.029	1.007	20.52	19.95	28.81	27.79	0.7177
75	1.014	1.008	20.74	20.45	29.17	28.55	0.7166
80	0.9996	1.008	20.96	20.97	29.53	29.31	0.7154
85	0.9857	1.008	21.17	21.48	29.88	30.07	0.7143
90	0.9721	1.008	21.39	22	30.24	30.85	0.7132
95	0.9589	1.009	21.6	22.52	30.6	31.63	0.7121
100	0.946	1.009	21.81	23.05	30.95	32.42	0.7111
110	0.9213	1.01	22.23	24.12	31.65	34.02	0.7092
120	0.8979	1.011	22.64	25.21	32.35	35.64	0.7073
130	0.8756	1.012	23.05	26.32	33.05	37.3	0.7057
140	0.8544	1.013	23.45	27.44	33.74	38.98	0.7041
150	0.8343	1.014	23.85	28.59	34.43	40.68	0.7027
160	0.815	1.016	24.24	29.74	35.11	42.4	0.7014
170	0.7966	1.017	24.63	30.92	35.79	44.15	0.7003
180	0.779	1.019	25.01	32.11	36.46	45.92	0.6992
190	0.7622	1.021	25.39	33.32	37.13	47.71	0.6983
200	0.7461	1.023	25.77	34.54	37.79	49.53	0.6974
210	0.7306	1.025	26.14	35.78	38.45	51.36	0.6967
220	0.7158	1.027	26.51	37.04	39.1	53.21	0.696
230	0.7016	1.029	26.88	38.31	39.75	55.08	0.6955
240	0.6879	1.031	27.24	39.6	40.4	56.97	0.695
250	0.6748	1.033	27.6	40.9	41.04	58.88	0.6946
260	0.6621	1.035	27.95	42.22	41.67	60.81	0.6942
270	0.6499	1.037	28.3	43.55	42.31	62.75	0.694
280	0.6382	1.04	28.65	44.9	42.93	64.72	0.6938
290	0.6269	1.042	29	46.26	43.56	66.69	0.6936
300	0.6159	1.044	29.34	47.64	44.18	68.69	0.6935

Tabla 4.4.1: Propiedades del aire seco a presión atmosférica (cont.)

T (°C)	ρ (kg/m ³)	c_p (kJ/kg·K)	$\mu \cdot 10^6$ (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
310	0.6054	1.047	29.68	49.03	44.79	70.7	0.6934
320	0.5951	1.049	30.01	50.43	45.4	72.73	0.6934
330	0.5853	1.051	30.35	51.85	46.01	74.77	0.6935
340	0.5757	1.054	30.68	53.29	46.61	76.83	0.6936
350	0.5665	1.056	31.01	54.73	47.21	78.9	0.6937
360	0.5576	1.059	31.33	56.19	47.81	80.99	0.6938
370	0.5489	1.061	31.65	57.67	48.4	83.09	0.694
380	0.5405	1.064	31.97	59.16	48.99	85.21	0.6943
390	0.5323	1.066	32.29	60.66	49.57	87.34	0.6945
400	0.5244	1.069	32.61	62.18	50.15	89.49	0.6948
410	0.5167	1.071	32.92	63.71	50.72	91.65	0.6951
420	0.5093	1.073	33.23	65.25	51.29	93.83	0.6954
430	0.502	1.076	33.54	66.8	51.86	96.02	0.6957
440	0.495	1.078	33.84	68.37	52.42	98.22	0.6961
450	0.4882	1.081	34.15	69.95	52.98	100.4	0.6965
460	0.4815	1.083	34.45	71.54	53.54	102.7	0.6969
470	0.475	1.085	34.75	73.15	54.09	104.9	0.6973
480	0.4687	1.088	35.04	74.77	54.64	107.2	0.6977
490	0.4626	1.09	35.34	76.4	55.18	109.4	0.6982
500	0.4566	1.093	35.63	78.04	55.72	111.7	0.6986
550	0.4289	1.104	37.07	86.44	58.37	123.3	0.7011
600	0.4043	1.115	38.46	95.12	60.93	135.2	0.7037
650	0.3824	1.125	39.81	104.1	63.41	147.4	0.7064
700	0.3628	1.135	41.11	113.3	65.81	159.8	0.7092
750	0.345	1.145	42.39	122.8	68.12	172.5	0.7121
800	0.329	1.153	43.62	132.6	70.37	185.5	0.7149
850	0.3143	1.162	44.83	142.6	72.54	198.7	0.7178
900	0.3009	1.169	46	152.9	74.65	212.2	0.7206
950	0.2886	1.177	47.15	163.4	76.7	225.8	0.7233
1000	0.2773	1.184	48.26	174.1	78.68	239.8	0.726
1100	0.2571	1.196	50.42	196.1	82.48	268.2	0.7312
1200	0.2396	1.207	52.48	219	86.09	297.6	0.736
1400	0.211	1.226	56.35	267.1	92.81	358.8	0.7444
1600	0.1885	1.241	59.92	317.9	99.08	423.6	0.7506
1800	0.1703	1.253	63.22	371.3	105.1	492.5	0.7539
2000	0.1553	1.264	66.3	426.9	111.1	566.2	0.7539

Fuente: Todas las propiedades de Keenan, Chao, Keyes, "Gas Tables", Wiley, 1985.

Excepto:

Conductividad de Y.S. Touloukian, P.E. Liley, S.C. Saxena "Thermophysical Properties of Matter - Vol 3", IFI/Plenum, NY, 1970

Viscosidad de Y.S. Touloukian, S.C. Saxena, and P. Hestermans "Thermophysical Properties of Matter - Vol 11", IFI/Plenum, NY, 1970

Tabla 4.4.2: Propiedades del Amoniaco a presión atmosférica

T (°C)	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
0	0.7715	2.179	93.58	12.13	21.97	13.07	0.9284
10	0.7426	2.169	97.11	13.08	23.02	14.29	0.9152
20	0.716	2.165	100.7	14.06	24.09	15.54	0.9047
30	0.6914	2.165	104.2	15.07	25.18	16.82	0.8962
40	0.6686	2.169	107.8	16.12	26.29	18.13	0.8894
50	0.6472	2.176	111.4	17.21	27.42	19.47	0.8838
60	0.6272	2.186	114.9	18.33	28.58	20.84	0.8792
70	0.6085	2.197	118.6	19.48	29.75	22.25	0.8755
80	0.5909	2.21	122.2	20.67	30.94	23.7	0.8724
90	0.5743	2.224	125.8	21.9	32.15	25.18	0.8699
100	0.5587	2.239	129.4	23.17	33.39	26.69	0.8678
120	0.5298	2.271	136.7	25.8	35.9	29.83	0.865
140	0.5039	2.307	144	28.59	38.49	33.11	0.8635
160	0.4804	2.345	151.4	31.52	41.14	36.52	0.863
180	0.459	2.385	158.8	34.6	43.86	40.07	0.8634
200	0.4395	2.426	166.2	37.82	46.64	43.75	0.8645
250	0.3972	2.533	184.8	46.53	53.83	53.5	0.8697
300	0.3624	2.645	203.5	56.15	61.34	63.99	0.8775
350	0.3333	2.759	222.2	66.68	69.1	75.15	0.8872
400	0.3085	2.875	240.9	78.1	77.09	86.94	0.8983

Fuente: S.A. Klein y F.L. Alvarado, "Engineering Equation Solver Software (EES)", Academia Versión 6.271 (20-07-2001).

Tabla 4.4.3: Propiedades del CO₂ a presión atmosférica

T (°C)	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
0	1.977	0.8268	137.1	6.935	14.66	8.968	0.7734
10	1.906	0.8364	142	7.452	15.43	9.683	0.7696
20	1.839	0.846	146.9	7.985	16.22	10.43	0.766
30	1.778	0.8556	151.7	8.535	17.03	11.2	0.7624
40	1.72	0.8651	156.5	9.101	17.84	11.99	0.759
50	1.666	0.8745	161.3	9.683	18.67	12.81	0.7557
60	1.616	0.8838	166.1	10.28	19.5	13.66	0.7527
70	1.568	0.8929	170.8	10.89	20.34	14.53	0.7498
80	1.523	0.9019	175.5	11.52	21.18	15.42	0.7472
90	1.481	0.9107	180.1	12.17	22.03	16.33	0.7447
100	1.441	0.9193	184.7	12.82	22.88	17.27	0.7425
120	1.367	0.9361	193.9	14.18	24.57	19.2	0.7386
140	1.3	0.9523	202.8	15.6	26.27	21.21	0.7353
160	1.24	0.9678	211.7	17.07	27.96	23.3	0.7327
180	1.185	0.9827	220.4	18.6	29.64	25.46	0.7306
200	1.135	0.9971	228.9	20.17	31.31	27.68	0.7289
250	1.026	1.031	249.7	24.34	35.44	33.52	0.7261
300	0.9361	1.061	269.6	28.8	39.47	39.74	0.7248
350	0.8609	1.089	288.8	33.54	43.41	46.31	0.7243
400	0.7968	1.114	307.2	38.55	47.26	53.23	0.7241
450	0.7417	1.137	324.9	43.8	51.02	60.49	0.7242
500	0.6937	1.159	342	49.3	54.72	68.1	0.7239

Fuente: S.A. Klein y F.L. Alvarado, "Engineering Equation Solver Software (EES)", Academia Versión 6.271 (20-07-2001).

Tabla 4.4.4: Propiedades del CO a presión atmosférica

T (°C)	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
0	1.25	1.041	163.9	13.11	24.59	18.9	0.6937
10	1.206	1.041	168.6	13.99	25.31	20.17	0.6933
20	1.164	1.04	173.3	14.88	26.01	21.48	0.693
30	1.126	1.04	177.9	15.8	26.71	22.81	0.6927
40	1.09	1.04	182.4	16.74	27.4	24.17	0.6924
50	1.056	1.04	186.9	17.69	28.07	25.56	0.6921
60	1.024	1.04	191.3	18.67	28.74	26.99	0.6919
70	0.9944	1.04	195.6	19.67	29.4	28.44	0.6917
80	0.9662	1.039	199.8	20.68	30.04	29.91	0.6915
90	0.9396	1.039	204	21.72	30.68	31.42	0.6913
100	0.9143	1.039	208.2	22.77	31.31	32.95	0.6911
120	0.8678	1.039	216.3	24.93	32.55	36.09	0.6907
140	0.8257	1.039	224.2	27.15	33.75	39.33	0.6904
160	0.7876	1.039	231.9	29.45	34.92	42.67	0.6901
180	0.7528	1.039	239.4	31.8	36.06	46.09	0.6899
200	0.7209	1.039	246.7	34.22	37.17	49.61	0.6897
250	0.652	1.04	264.1	40.51	39.85	58.78	0.6892
300	0.5951	1.04	280.6	47.16	42.38	68.45	0.6889
350	0.5473	1.041	296.3	54.14	44.8	78.61	0.6887
400	0.5067	1.042	311.4	61.46	47.13	89.25	0.6886
450	0.4716	1.043	326	69.11	49.4	100.4	0.6885
500	0.4411	1.045	340.2	77.12	51.63	112	0.6885

Fuente: S.A. Klein y F.L. Alvarado, "Engineering Equation Solver Software (EES)", Academia Versión 6.271 (20-07-2001).

Tabla 4.4.5: Propiedades del vapor de agua a presión atmosférica

T (°C)	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
100.1	0.5973	2.044	122.7	20.54	25.1	20.56	0.9992
110	0.5808	2.023	126.4	21.77	25.78	21.94	0.992
120	0.5652	2.007	130.2	23.04	26.5	23.37	0.9861
130	0.5504	1.995	134	24.35	27.26	24.82	0.9812
140	0.5365	1.987	137.9	25.71	28.05	26.31	0.9771
150	0.5233	1.981	141.8	27.1	28.86	27.84	0.9735
160	0.5108	1.977	145.8	28.53	29.7	29.41	0.9703
170	0.4989	1.975	149.7	30.01	30.57	31.02	0.9675
180	0.4876	1.974	153.7	31.52	31.45	32.67	0.9649
190	0.4768	1.975	157.7	33.08	32.36	34.37	0.9624
200	0.4665	1.976	161.8	34.68	33.28	36.11	0.9602
220	0.4472	1.98	169.9	37.99	35.19	39.74	0.9559
240	0.4295	1.986	178.1	41.46	37.16	43.56	0.9519
260	0.4131	1.994	186.3	45.1	39.19	47.57	0.948
280	0.398	2.003	194.6	48.89	41.28	51.77	0.9444
300	0.384	2.013	202.9	52.84	43.41	56.16	0.9408
350	0.3529	2.04	223.7	63.38	48.96	67.98	0.9323
400	0.3266	2.07	244.5	74.87	54.75	80.98	0.9245
450	0.3039	2.102	265.2	87.26	60.76	95.13	0.9173
500	0.2842	2.135	285.7	100.5	66.97	110.4	0.9108
550	0.2669	2.168	306.1	114.7	73.35	126.8	0.9048
600	0.2516	2.203	326.2	129.7	79.89	144.2	0.8994

Fuente: S.A. Klein y F.L. Alvarado, "Engineering Equation Solver Software (EES)", Academia Versión 6.271 (20-07-2001).

Tabla 4.5: Propiedades del agua líquida a presión atmosférica

T (°C)	ρ (kg/m ³)	c_p (kJ/kg·K)	$\mu \cdot 10^6$ (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)	$\beta \cdot 10^3$ (1/K)	Pr
0.001	1005	4.213	1766	1.757	567.2	0.1339	-0.08021	13.12
5	1004	4.201	1506	1.500	574.8	0.1363	0.01135	11.00
10	1003	4.191	1300	1.297	583.0	0.1387	0.08744	9.348
15	1001	4.184	1135	1.134	591.4	0.1412	0.1523	8.033
20	999.5	4.180	1001	1.001	599.8	0.1436	0.209	6.975
25	997.9	4.176	890.1	0.8920	608.0	0.1459	0.2594	6.114
30	996.2	4.175	797.6	0.8007	616.0	0.1481	0.3051	5.406
35	994.3	4.174	719.6	0.7238	623.6	0.1503	0.347	4.817
40	992.4	4.174	653.3	0.6583	630.7	0.1523	0.3859	4.323
45	990.3	4.175	596.3	0.6022	637.4	0.1542	0.4225	3.906
50	988.1	4.177	547.1	0.5537	643.6	0.1559	0.4572	3.551
55	985.7	4.179	504.2	0.5115	649.3	0.1576	0.4903	3.245
60	983.2	4.182	466.6	0.4746	654.4	0.1592	0.5221	2.981
65	980.6	4.184	433.5	0.4420	659.1	0.1606	0.5528	2.752
70	977.9	4.188	404.1	0.4132	663.2	0.1620	0.5827	2.551
75	975.0	4.191	378.0	0.3877	666.9	0.1632	0.6118	2.375
80	971.9	4.195	354.6	0.3648	670.2	0.1644	0.6402	2.219
85	968.8	4.199	333.6	0.3443	673.0	0.1654	0.6682	2.081
90	965.5	4.204	314.6	0.3259	675.5	0.1664	0.6958	1.958
95	962.1	4.209	297.5	0.3092	677.5	0.1673	0.723	1.848
100	958.5	4.214	281.9	0.2941	679.3	0.1682	0.7501	1.749

Fuente: S.A. Klein y F.L. Alvarado, "Engineering Equation Solver Software (EES)", Academia Versión 6.271 (20-07-2001).

Tabla 4.6: Propiedades termofísicas del agua saturada

T (°C)	p_{sat} (kPa)	Δh_{l-g} (kJ/kg)	ρ_l (kg/m ³)	v_g (m ³ /kg)	$C_{p,l}$ (kJ/kg·K)	$C_{p,g}$ (kJ/kg·K)	$\mu_l \cdot 10^6$ (N·s/m ²)	$\mu_g \cdot 10^6$ (N·s/m ²)	$k_l \cdot 10^3$ (W/m·K)	$k_g \cdot 10^3$ (W/m·K)	Pr_l	Pr_g	$\beta_l \cdot 10^3$ (1/k)
0.001	0.6113	2501	1000	206.1	4.229	1.868	1793	9.216	561	17.07	13.52	1.008	-0.08063
5	0.8726	2489	1000	147	4.2	1.871	1519	9.336	570.5	17.34	11.18	1.007	0.01103
10	1.228	2477	999.7	106.3	4.188	1.874	1307	9.461	580	17.62	9.435	1.006	0.08719
15	1.706	2465	999.1	77.9	4.184	1.878	1138	9.592	589.3	17.92	8.081	1.005	0.1522
20	2.339	2453	998.2	57.78	4.183	1.882	1002	9.727	598.4	18.23	7.006	1.004	0.2089
25	3.169	2442	997	43.36	4.183	1.887	890.5	9.867	607.1	18.55	6.136	1.004	0.2593
30	4.246	2430	995.6	32.9	4.183	1.892	797.7	10.01	615.4	18.88	5.422	1.003	0.305
35	5.627	2418	994	25.22	4.183	1.898	719.6	10.16	623.3	19.23	4.83	1.002	0.3469
40	7.381	2406	992.2	19.53	4.182	1.904	653.3	10.31	630.6	19.6	4.333	1.002	0.3859
45	9.59	2394	990.2	15.26	4.182	1.912	596.3	10.46	637.3	19.97	3.913	1.001	0.4225
50	12.34	2382	988	12.04	4.182	1.919	547.1	10.62	643.5	20.36	3.555	1.001	0.4572
55	15.75	2370	985.7	9.573	4.182	1.928	504.2	10.77	649.2	20.77	3.248	1	0.4903
60	19.93	2358	983.2	7.674	4.183	1.937	466.6	10.93	654.3	21.18	2.983	0.9998	0.5222
65	25.02	2345	980.5	6.2	4.184	1.947	433.4	11.1	659	21.62	2.752	0.9995	0.5529
70	31.18	2333	977.7	5.045	4.187	1.958	404	11.26	663.1	22.07	2.551	0.9992	0.5827
75	38.56	2321	974.8	4.133	4.19	1.97	377.9	11.43	666.8	22.53	2.375	0.999	0.6118
80	47.37	2308	971.8	3.409	4.194	1.983	354.5	11.59	670	23.01	2.219	0.9989	0.6403
85	57.81	2295	968.6	2.829	4.199	1.996	333.5	11.76	672.8	23.5	2.081	0.9988	0.6682
90	70.12	2283	965.3	2.362	4.204	2.011	314.5	11.93	675.3	24.02	1.958	0.9989	0.6958
95	84.53	2270	961.9	1.983	4.21	2.027	297.4	12.1	677.4	24.55	1.849	0.999	0.723
100	101.3	2257	958.4	1.674	4.217	2.044	281.9	12.27	679.1	25.09	1.75	0.9993	0.7501
110	143.2	2230	951	1.211	4.232	2.082	254.8	12.61	681.7	26.24	1.582	1.001	0.8038
120	198.5	2202	943.2	0.8922	4.249	2.125	232.1	12.96	683.2	27.46	1.444	1.003	0.8576
130	270	2174	934.9	0.6687	4.267	2.175	213	13.3	683.7	28.76	1.329	1.006	0.9122
140	361.2	2145	926.2	0.509	4.288	2.233	196.6	13.65	683.3	30.13	1.234	1.011	0.9683
150	475.7	2114	917.1	0.3929	4.312	2.298	182.5	13.99	682.1	31.58	1.154	1.018	1.026
160	617.7	2082	907.5	0.3071	4.338	2.373	170.3	14.34	680	33.11	1.086	1.028	1.087
170	791.5	2049	897.5	0.2428	4.368	2.459	159.6	14.68	677.1	34.72	1.03	1.04	1.152
180	1002	2015	887.1	0.194	4.403	2.557	150.2	15.03	673.4	36.41	0.982	1.055	1.221
190	1254	1978	876.1	0.1565	4.443	2.669	141.8	15.37	668.8	38.18	0.9421	1.074	1.296
200	1554	1940	864.7	0.1273	4.489	2.796	134.4	15.71	663.4	40.03	0.9092	1.097	1.377
220	2318	1858	840.3	0.08616	4.604	3.107	121.6	16.41	649.8	43.99	0.8613	1.159	1.567
240	3345	1766	813.5	0.05974	4.759	3.516	110.9	17.12	632	48.31	0.8351	1.246	1.807
260	4689	1662	783.8	0.04219	4.973	4.064	101.7	17.88	609.2	53.1	0.8304	1.368	2.126
280	6413	1543	750.5	0.03016	5.278	4.828	93.56	18.7	580.3	58.53	0.8511	1.542	2.576
300	8584	1405	712.4	0.02167	5.744	5.967	85.95	19.65	543.6	64.98	0.9083	1.804	3.266
320	11279	1238	667.4	0.01548	6.542	7.87	78.46	20.84	496.7	73.25	1.033	2.24	4.47
340	14594	1028	610.8	0.01079	8.237	11.79	70.45	22.55	435.6	85.24	1.332	3.118	7.116
360	18655	721.1	528.1	0.006962	14.68	25.28	60.39	25.71	351	107.5	2.525	6.046	17.11

Fuente: S.A. Klein y F.L. Alvarado, "Engineering Equation Solver Software (EES)", Academia Versión 6.271 (20-07-2001).