

DuPont™ ISCEON® 9 Series

REFRIGERANTS

Technical Information

Thermodynamic Properties of DuPont™ ISCEON® M059 (R-417A) SI Units



The miracles of science™

Thermodynamic Properties of DuPont™ ISCEON® MO59 (R-417A) Refrigerant (R-125/R-134a/R-600 – 46.6/50/0/3.4% by weight)

SI Units

Tables of the thermodynamic properties of ISCEON® MO59 (R-417A) have been developed and are presented here. This information is based on values calculated using the NIST REFPROP Database (McLinden, M.O., Klein, S.A., Lemmon, E.W., and Peskin, A.P., NIST Standard Reference Database 23, NIST thermodynamic and transport properties of refrigerants and refrigerant mixtures – REFPROP version 7.0, Standard Reference Data Program, National Institute of Standards and Technology, 2005).

Units

P = Pressure in kPa (absolute)

T = Temperature in Celsius

V_f = Fluid (liquid) specific volume in cubic Meters per kilogram

V_g = Vapour (gas) specific volume in cubic Meters per kilogram

d_f = Density of saturated vapour in kilograms per cubic meter

d_g = Density of saturated liquid in kilograms per cubic meter

h = Enthalpy (kJ/kg)

s = Entropy (kJ/kg·K)

Reference points for Enthalpy and Entropy:

h_f = 200 kJ/kg at 0°C

s_f = 1 kJ/kg·K at 0°C

Physical Properties

Chemical Formula	CHF ₂ CF ₃ /CH ₂ FCF ₃ /CH ₃ CH ₂ CH ₂ CH ₃ (46.6/50.0/3.4% by weight)
Molecular mass	106.75
Boiling Point At one atmosphere	-39.12°C
Critical Temperature	87.04°C
Critical Pressure	4036 kPa

Table 1
DuPont™ ISCEON® MO59 (R-417A) Saturation Properties— Temperature Table

TEMP. °C	PRESSURE (kPa)		VOLUME (m ³ /kg)		DENSITY (kg/m ³)		ENTHALPY (kJ/kg)			ENTROPY (kJ/K·kg)		TEMP. °C
	LIQUID	VAPOUR	LIQUID v _l	VAPOUR v _g	LIQUID d _l	VAPOUR d _g	LIQUID h _l	LATENT h _{lg}	VAPOUR h _g	LIQUID s _l	VAPOUR s _g	
-100	1.8	0.9	0.0006	14.6370	1562.1	0.068	75.9	233.5	309.3	0.4378	1.8120	-100
-99	2.0	1.0	0.0006	13.2540	1559.1	0.075	77.1	232.8	309.9	0.4448	1.8073	-99
-98	2.2	1.1	0.0006	12.0180	1556.1	0.083	78.3	232.2	310.5	0.4517	1.8026	-98
-97	2.4	1.3	0.0006	10.9130	1553.1	0.092	79.5	231.6	311.1	0.4586	1.7981	-97
-96	2.6	1.4	0.0006	9.9230	1550.1	0.101	80.7	231.0	311.7	0.4655	1.7937	-96
-95	2.8	1.5	0.0006	9.0351	1547.1	0.111	81.9	230.4	312.3	0.4723	1.7893	-95
-94	3.1	1.7	0.0006	8.2375	1544.1	0.121	83.2	229.8	312.9	0.4790	1.7851	-94
-93	3.4	1.9	0.0006	7.5201	1541.1	0.133	84.4	229.2	313.5	0.4858	1.7810	-93
-92	3.7	2.0	0.0007	6.8738	1538.1	0.145	85.6	228.6	314.1	0.4924	1.7769	-92
-91	4.0	2.2	0.0007	6.2909	1535.2	0.159	86.8	228.0	314.7	0.4991	1.7730	-91
-90	4.3	2.5	0.0007	5.7645	1532.2	0.173	88.0	227.4	315.3	0.5057	1.7691	-90
-89	4.7	2.7	0.0007	5.2885	1529.3	0.189	89.2	226.8	316.0	0.5122	1.7653	-89
-88	5.1	3.0	0.0007	4.8575	1526.3	0.206	90.4	226.2	316.6	0.5187	1.7616	-88
-87	5.5	3.2	0.0007	4.4668	1523.4	0.224	91.6	225.6	317.2	0.5252	1.7580	-87
-86	6.0	3.5	0.0007	4.1121	1520.4	0.243	92.8	225.0	317.8	0.5316	1.7545	-86
-85	6.5	3.9	0.0007	3.7898	1517.5	0.264	94.0	224.4	318.4	0.5380	1.7510	-85
-84	7.0	4.2	0.0007	3.4966	1514.5	0.286	95.2	223.8	319.0	0.5444	1.7476	-84
-83	7.5	4.6	0.0007	3.2295	1511.6	0.310	96.4	223.2	319.6	0.5507	1.7443	-83
-82	8.1	5.0	0.0007	2.9860	1508.7	0.335	97.6	222.7	320.3	0.5570	1.7411	-82
-81	8.7	5.4	0.0007	2.7636	1505.7	0.362	98.8	222.1	320.9	0.5633	1.7380	-81
-80	9.4	5.8	0.0007	2.5604	1502.8	0.391	100.0	221.5	321.5	0.5695	1.7349	-80
-79	10.1	6.3	0.0007	2.3745	1499.9	0.421	101.2	220.9	322.1	0.5757	1.7319	-79
-78	10.8	6.9	0.0007	2.2043	1496.9	0.454	102.4	220.3	322.7	0.5819	1.7290	-78
-77	11.6	7.4	0.0007	2.0482	1494.0	0.488	103.6	219.8	323.4	0.5880	1.7261	-77
-76	12.5	8.0	0.0007	1.9049	1491.1	0.525	104.8	219.2	324.0	0.5941	1.7233	-76
-75	13.4	8.6	0.0007	1.7733	1488.1	0.564	106.0	218.6	324.6	0.6002	1.7206	-75
-74	14.3	9.3	0.0007	1.6523	1485.2	0.605	107.2	218.0	325.2	0.6062	1.7179	-74
-73	15.3	10.0	0.0007	1.5409	1482.3	0.649	108.4	217.5	325.9	0.6123	1.7153	-73
-72	16.4	10.8	0.0007	1.4383	1479.3	0.695	109.6	216.9	326.5	0.6183	1.7127	-72
-71	17.5	11.6	0.0007	1.3436	1476.4	0.744	110.8	216.3	327.1	0.6242	1.7102	-71
-70	18.6	12.5	0.0007	1.2562	1473.5	0.796	112.0	215.7	327.7	0.6302	1.7078	-70
-69	19.9	13.4	0.0007	1.1755	1470.5	0.851	113.2	215.2	328.4	0.6361	1.7054	-69
-68	21.2	14.4	0.0007	1.1009	1467.6	0.908	114.4	214.6	329.0	0.6419	1.7031	-68
-67	22.5	15.4	0.0007	1.0318	1464.6	0.969	115.6	214.0	329.6	0.6478	1.7009	-67
-66	24.0	16.5	0.0007	0.9678	1461.7	1.033	116.8	213.4	330.3	0.6536	1.6986	-66
-65	25.5	17.6	0.0007	0.9085	1458.7	1.101	118.0	212.9	330.9	0.6595	1.6965	-65
-64	27.1	18.8	0.0007	0.8534	1455.8	1.172	119.3	212.3	331.5	0.6652	1.6944	-64
-63	28.8	20.1	0.0007	0.8023	1452.8	1.246	120.5	211.7	332.2	0.6710	1.6923	-63
-62	30.5	21.5	0.0007	0.7548	1449.9	1.325	121.7	211.1	332.8	0.6767	1.6903	-62
-61	32.4	22.9	0.0007	0.7106	1446.9	1.407	122.9	210.5	333.4	0.6825	1.6884	-61
-60	34.3	24.4	0.0007	0.6695	1443.9	1.494	124.1	210.0	334.1	0.6881	1.6865	-60
-59	36.4	26.0	0.0007	0.6311	1440.9	1.585	125.3	209.4	334.7	0.6938	1.6846	-59
-58	38.5	27.7	0.0007	0.5954	1438.0	1.680	126.5	208.8	335.3	0.6995	1.6828	-58
-57	40.7	29.4	0.0007	0.5621	1435.0	1.779	127.7	208.2	336.0	0.7051	1.6810	-57
-56	43.0	31.3	0.0007	0.5309	1432.0	1.883	129.0	207.6	336.6	0.7107	1.6793	-56
-55	45.5	33.2	0.0007	0.5019	1429.0	1.993	130.2	207.1	337.2	0.7163	1.6776	-55
-54	48.0	35.2	0.0007	0.4747	1426.0	2.107	131.4	206.5	337.9	0.7219	1.6760	-54
-53	50.7	37.4	0.0007	0.4492	1423.0	2.226	132.6	205.9	338.5	0.7274	1.6744	-53
-52	53.5	39.6	0.0007	0.4254	1420.0	2.351	133.8	205.3	339.1	0.7329	1.6728	-52
-51	56.3	41.9	0.0007	0.4031	1417.0	2.481	135.1	204.7	339.8	0.7384	1.6713	-51
-50	59.4	44.4	0.0007	0.3822	1414.0	2.617	136.3	204.1	340.4	0.7439	1.6698	-50
-49	62.5	47.0	0.0007	0.3626	1410.9	2.758	137.5	203.5	341.0	0.7494	1.6684	-49
-48	65.8	49.7	0.0007	0.3441	1407.9	2.906	138.7	202.9	341.7	0.7549	1.6670	-48
-47	69.2	52.5	0.0007	0.3268	1404.9	3.060	140.0	202.3	342.3	0.7603	1.6656	-47
-46	72.8	55.4	0.0007	0.3106	1401.8	3.220	141.2	201.7	342.9	0.7657	1.6643	-46
-45	76.5	58.5	0.0007	0.2953	1398.8	3.387	142.4	201.1	343.6	0.7711	1.6630	-45
-44	80.3	61.7	0.0007	0.2809	1395.7	3.561	143.7	200.5	344.2	0.7765	1.6617	-44
-43	84.3	65.0	0.0007	0.2673	1392.6	3.741	144.9	199.9	344.8	0.7819	1.6605	-43
-42	88.5	68.5	0.0007	0.2545	1389.5	3.929	146.1	199.3	345.4	0.7872	1.6593	-42
-41	92.8	72.1	0.0007	0.2425	1386.5	4.124	147.4	198.7	346.1	0.7925	1.6581	-41

Table 1 (continued)
DuPont™ ISCEON® MO59 (R-417A) Saturation Properties—Temperature Table

TEMP. °C	PRESSURE (kPa)		VOLUME (m ³ /kg)		DENSITY (kg/m ³)		ENTHALPY (kJ/kg)			ENTROPY (kJ/K·kg)		TEMP. °C
	LIQUID	VAPOUR	LIQUID v _l	VAPOUR v _g	LIQUID d _l	VAPOUR d _g	LIQUID h _l	LATENT h _{lg}	VAPOUR h _g	LIQUID s _l	VAPOUR s _g	
-40	97.2	75.9	0.0007	0.2311	1383.4	4.327	148.6	198.1	346.7	0.7979	1.6570	-40
-39	101.9	79.8	0.0007	0.2204	1380.3	4.538	149.9	197.5	347.3	0.8032	1.6559	-39
-38	106.7	83.9	0.0007	0.2103	1377.1	4.756	151.1	196.9	348.0	0.8084	1.6548	-38
-37	111.7	88.1	0.0007	0.2007	1374.0	4.983	152.3	196.3	348.6	0.8137	1.6537	-37
-36	116.9	92.6	0.0007	0.1916	1370.9	5.218	153.6	195.6	349.2	0.8190	1.6527	-36
-35	122.3	97.2	0.0007	0.1831	1367.8	5.462	154.8	195.0	349.8	0.8242	1.6517	-35
-34	127.8	102.0	0.0007	0.1750	1364.6	5.715	156.1	194.4	350.5	0.8294	1.6508	-34
-33	133.6	106.9	0.0007	0.1673	1361.5	5.977	157.3	193.7	351.1	0.8346	1.6498	-33
-32	139.5	112.1	0.0007	0.1600	1358.3	6.248	158.6	193.1	351.7	0.8398	1.6489	-32
-31	145.7	117.4	0.0007	0.1532	1355.1	6.529	159.9	192.5	352.3	0.8450	1.6480	-31
-30	152.1	122.9	0.0007	0.1466	1351.9	6.820	161.1	191.8	352.9	0.8502	1.6471	-30
-29	158.6	128.7	0.0007	0.1404	1348.7	7.121	162.4	191.2	353.6	0.8554	1.6463	-29
-28	165.5	134.6	0.0007	0.1346	1345.5	7.432	163.6	190.6	354.2	0.8605	1.6455	-28
-27	172.5	140.8	0.0007	0.1290	1342.3	7.754	164.9	189.9	354.8	0.8656	1.6447	-27
-26	179.7	147.2	0.0007	0.1237	1339.1	8.086	166.2	189.3	355.4	0.8707	1.6439	-26
-25	187.2	153.8	0.0007	0.1186	1335.8	8.430	167.4	188.6	356.0	0.8758	1.6432	-25
-24	195.0	160.6	0.0008	0.1138	1332.5	8.785	168.7	187.9	356.6	0.8809	1.6424	-24
-23	203.0	167.7	0.0008	0.1093	1329.3	9.152	170.0	187.3	357.3	0.8860	1.6417	-23
-22	211.2	175.0	0.0008	0.1049	1326.0	9.531	171.3	186.6	357.9	0.8911	1.6410	-22
-21	219.7	182.5	0.0008	0.1008	1322.7	9.922	172.5	185.9	358.5	0.8961	1.6404	-21
-20	228.4	190.3	0.0008	0.0968	1319.4	10.325	173.8	185.3	359.1	0.9012	1.6397	-20
-19	237.4	198.4	0.0008	0.0931	1316.1	10.742	175.1	184.6	359.7	0.9062	1.6391	-19
-18	246.7	206.7	0.0008	0.0895	1312.7	11.171	176.4	183.9	360.3	0.9112	1.6385	-18
-17	256.3	215.3	0.0008	0.0861	1309.4	11.614	177.7	183.2	360.9	0.9163	1.6379	-17
-16	266.1	224.1	0.0008	0.0828	1306.0	12.071	179.0	182.5	361.5	0.9213	1.6373	-16
-15	276.3	233.3	0.0008	0.0797	1302.7	12.542	180.3	181.8	362.1	0.9263	1.6368	-15
-14	286.7	242.7	0.0008	0.0768	1299.3	13.027	181.6	181.1	362.7	0.9312	1.6362	-14
-13	297.4	252.4	0.0008	0.0739	1295.9	13.527	182.9	180.4	363.3	0.9362	1.6357	-13
-12	308.4	262.4	0.0008	0.0712	1292.4	14.042	184.2	179.7	363.9	0.9412	1.6352	-12
-11	319.8	272.7	0.0008	0.0686	1289.0	14.572	185.5	179.0	364.5	0.9461	1.6347	-11
-10	331.4	283.3	0.0008	0.0661	1285.5	15.118	186.8	178.3	365.1	0.9511	1.6342	-10
-9	343.4	294.3	0.0008	0.0638	1282.1	15.680	188.1	177.6	365.6	0.9560	1.6337	-9
-8	355.7	305.5	0.0008	0.0615	1278.6	16.259	189.4	176.8	366.2	0.9609	1.6333	-8
-7	368.4	317.1	0.0008	0.0593	1275.1	16.854	190.7	176.1	366.8	0.9658	1.6328	-7
-6	381.3	329.0	0.0008	0.0573	1271.5	17.467	192.0	175.4	367.4	0.9707	1.6324	-6
-5	394.7	341.3	0.0008	0.0553	1268.0	18.098	193.4	174.6	368.0	0.9756	1.6320	-5
-4	408.3	353.9	0.0008	0.0533	1264.4	18.746	194.7	173.9	368.5	0.9805	1.6316	-4
-3	422.3	366.8	0.0008	0.0515	1260.9	19.414	196.0	173.1	369.1	0.9854	1.6312	-3
-2	436.7	380.1	0.0008	0.0498	1257.3	20.100	197.3	172.3	369.7	0.9903	1.6308	-2
-1	451.5	393.8	0.0008	0.0481	1253.7	20.805	198.7	171.6	370.2	0.9951	1.6304	-1
0	466.6	407.8	0.0008	0.0464	1250.0	21.530	200.0	170.8	370.8	1.0000	1.6301	0
1	482.1	422.2	0.0008	0.0449	1246.4	22.275	201.3	170.0	371.4	1.0049	1.6297	1
2	498.0	437.0	0.0008	0.0434	1242.7	23.042	202.7	169.2	371.9	1.0097	1.6294	2
3	514.3	452.2	0.0008	0.0420	1239.0	23.829	204.0	168.5	372.5	1.0145	1.6290	3
4	531.0	467.8	0.0008	0.0406	1235.2	24.638	205.4	167.7	373.0	1.0194	1.6287	4
5	548.1	483.7	0.0008	0.0393	1231.5	25.469	206.7	166.9	373.6	1.0242	1.6284	5
6	565.6	500.1	0.0008	0.0380	1227.7	26.323	208.1	166.0	374.1	1.0290	1.6281	6
7	583.6	517.0	0.0008	0.0368	1223.9	27.201	209.5	165.2	374.7	1.0338	1.6278	7
8	601.9	534.2	0.0008	0.0356	1220.1	28.102	210.8	164.4	375.2	1.0386	1.6275	8
9	620.7	551.8	0.0008	0.0345	1216.3	29.027	212.2	163.6	375.8	1.0434	1.6272	9
10	639.9	569.9	0.0008	0.0334	1212.4	29.978	213.6	162.7	376.3	1.0482	1.6269	10
11	659.6	588.5	0.0008	0.0323	1208.5	30.954	214.9	161.9	376.8	1.0530	1.6266	11
12	679.7	607.5	0.0008	0.0313	1204.6	31.957	216.3	161.0	377.3	1.0578	1.6264	12
13	700.3	626.9	0.0008	0.0303	1200.7	32.987	217.7	160.2	377.9	1.0626	1.6261	13
14	721.3	646.9	0.0008	0.0294	1196.7	34.044	219.1	159.3	378.4	1.0674	1.6258	14
15	742.8	667.3	0.0008	0.0285	1192.7	35.129	220.5	158.4	378.9	1.0722	1.6256	15
16	764.8	688.1	0.0008	0.0276	1188.6	36.244	221.9	157.5	379.4	1.0769	1.6253	16
17	787.2	709.5	0.0008	0.0267	1184.6	37.388	223.3	156.6	379.9	1.0817	1.6250	17
18	810.2	731.3	0.0008	0.0259	1180.5	38.563	224.7	155.7	380.4	1.0865	1.6248	18
19	833.6	753.7	0.0009	0.0251	1176.3	39.769	226.1	154.8	380.9	1.0912	1.6245	19

Table 1 (continued)
DuPont™ ISCEON® MO59 (R-417A) Saturation Properties—Temperature Table

TEMP. °C	PRESSURE (kPa)		VOLUME (m ³ /kg)		DENSITY (kg/m ³)		ENTHALPY (kJ/kg)			ENTROPY (kJ/K·kg)		TEMP. °C
	LIQUID	VAPOUR	LIQUID v _l	VAPOUR v _g	LIQUID d _l	VAPOUR d _g	LIQUID h _l	LATENT h _{lg}	VAPOUR h _g	LIQUID s _l	VAPOUR s _g	
20	857.6	776.6	0.0009	0.0244	1172.2	41.007	227.5	153.9	381.4	1.0960	1.6243	20
21	882.1	799.9	0.0009	0.0237	1168.0	42.278	228.9	153.0	381.9	1.1008	1.6240	21
22	907.1	823.8	0.0009	0.0229	1163.8	43.584	230.3	152.0	382.4	1.1055	1.6238	22
23	932.6	848.3	0.0009	0.0223	1159.5	44.924	231.8	151.1	382.8	1.1103	1.6235	23
24	958.6	873.3	0.0009	0.0216	1155.2	46.300	233.2	150.1	383.3	1.1150	1.6232	24
25	985.2	898.8	0.0009	0.0210	1150.9	47.712	234.6	149.1	383.8	1.1198	1.6230	25
26	1012.3	924.9	0.0009	0.0203	1146.5	49.163	236.1	148.2	384.2	1.1245	1.6227	26
27	1040.0	951.5	0.0009	0.0197	1142.1	50.653	237.5	147.2	384.7	1.1293	1.6224	27
28	1068.2	978.7	0.0009	0.0192	1137.6	52.182	239.0	146.1	385.1	1.1340	1.6222	28
29	1097.0	1006.5	0.0009	0.0186	1133.1	53.753	240.4	145.1	385.6	1.1388	1.6219	29
30	1126.4	1034.9	0.0009	0.0181	1128.6	55.367	241.9	144.1	386.0	1.1435	1.6216	30
31	1156.4	1063.9	0.0009	0.0175	1124.0	57.024	243.4	143.1	386.4	1.1483	1.6213	31
32	1187.0	1093.5	0.0009	0.0170	1119.3	58.727	244.9	142.0	386.9	1.1530	1.6210	32
33	1218.1	1123.7	0.0009	0.0165	1114.6	60.476	246.3	140.9	387.3	1.1578	1.6207	33
34	1249.9	1154.5	0.0009	0.0161	1109.9	62.273	247.8	139.9	387.7	1.1626	1.6204	34
35	1282.3	1185.9	0.0009	0.0156	1105.1	64.120	249.3	138.8	388.1	1.1673	1.6201	35
36	1315.3	1218.0	0.0009	0.0151	1100.3	66.018	250.8	137.7	388.5	1.1721	1.6198	36
37	1348.9	1250.8	0.0009	0.0147	1095.4	67.969	252.3	136.5	388.9	1.1769	1.6194	37
38	1383.2	1284.2	0.0009	0.0143	1090.4	69.975	253.8	135.4	389.2	1.1816	1.6191	38
39	1418.1	1318.2	0.0009	0.0139	1085.4	72.037	255.4	134.2	389.6	1.1864	1.6187	39
40	1453.6	1353.0	0.0009	0.0135	1080.4	74.159	256.9	133.1	390.0	1.1912	1.6183	40
41	1489.8	1388.4	0.0009	0.0131	1075.2	76.341	258.4	131.9	390.3	1.1960	1.6179	41
42	1526.7	1424.5	0.0009	0.0127	1070.0	78.586	260.0	130.7	390.6	1.2008	1.6175	42
43	1564.3	1461.3	0.0009	0.0124	1064.8	80.897	261.5	129.4	391.0	1.2056	1.6171	43
44	1602.6	1498.9	0.0009	0.0120	1059.4	83.276	263.1	128.2	391.3	1.2104	1.6167	44
45	1641.5	1537.1	0.0009	0.0117	1054.0	85.726	264.7	126.9	391.6	1.2152	1.6162	45
46	1681.2	1576.1	0.0010	0.0113	1048.5	88.249	266.2	125.7	391.9	1.2201	1.6158	46
47	1721.5	1615.8	0.0010	0.0110	1043.0	90.849	267.8	124.4	392.2	1.2249	1.6153	47
48	1762.6	1656.3	0.0010	0.0107	1037.3	93.529	269.4	123.0	392.5	1.2298	1.6148	48
49	1804.5	1697.6	0.0010	0.0104	1031.6	96.292	271.0	121.7	392.7	1.2346	1.6142	49
50	1847.0	1739.6	0.0010	0.0101	1025.8	99.143	272.6	120.3	393.0	1.2395	1.6137	50
51	1890.3	1782.5	0.0010	0.0098	1019.9	102.080	274.3	118.9	393.2	1.2444	1.6131	51
52	1934.4	1826.1	0.0010	0.0095	1013.9	105.120	275.9	117.5	393.4	1.2493	1.6125	52
53	1979.2	1870.5	0.0010	0.0092	1007.7	108.260	277.6	116.1	393.6	1.2542	1.6118	53
54	2024.8	1915.8	0.0010	0.0090	1001.5	111.500	279.2	114.6	393.8	1.2592	1.6111	54
55	2071.2	1961.9	0.0010	0.0087	995.2	114.850	280.9	113.1	394.0	1.2641	1.6104	55
56	2118.4	2008.9	0.0010	0.0085	988.7	118.320	282.6	111.6	394.2	1.2691	1.6097	56
57	2166.4	2056.7	0.0010	0.0082	982.1	121.920	284.3	110.0	394.3	1.2741	1.6089	57
58	2215.3	2105.4	0.0010	0.0080	975.4	125.640	286.0	108.4	394.4	1.2792	1.6081	58
59	2264.9	2155.0	0.0010	0.0077	968.5	129.500	287.7	106.8	394.5	1.2842	1.6072	59
60	2315.4	2205.5	0.0010	0.0075	961.5	133.510	289.5	105.2	394.6	1.2893	1.6063	60
61	2366.8	2256.9	0.0010	0.0073	954.3	137.670	291.2	103.4	394.7	1.2944	1.6053	61
62	2419.0	2309.2	0.0011	0.0070	946.9	142.000	293.0	101.7	394.7	1.2996	1.6043	62
63	2472.0	2362.5	0.0011	0.0068	939.4	146.510	294.8	99.9	394.7	1.3048	1.6032	63
64	2526.0	2416.8	0.0011	0.0066	931.6	151.200	296.6	98.1	394.7	1.3100	1.6021	64
65	2580.9	2472.1	0.0011	0.0064	923.6	156.110	298.5	96.2	394.6	1.3153	1.6009	65
66	2636.6	2528.4	0.0011	0.0062	915.4	161.230	300.3	94.2	394.5	1.3206	1.5996	66
67	2693.4	2585.7	0.0011	0.0060	907.0	166.600	302.2	92.2	394.4	1.3260	1.5982	67
68	2751.0	2644.1	0.0011	0.0058	898.2	172.230	304.1	90.2	394.3	1.3314	1.5967	68
69	2809.6	2703.6	0.0011	0.0056	889.2	178.140	306.1	88.0	394.1	1.3369	1.5952	69
70	2869.1	2764.2	0.0011	0.0054	879.8	184.370	308.0	85.8	393.8	1.3425	1.5935	70
71	2929.7	2825.9	0.0011	0.0052	870.1	190.960	310.1	83.5	393.5	1.3481	1.5917	71
72	2991.2	2888.7	0.0012	0.0051	859.9	197.930	312.1	81.1	393.2	1.3539	1.5897	72
73	3053.7	2952.8	0.0012	0.0049	849.3	205.340	314.2	78.6	392.8	1.3597	1.5876	73
74	3117.3	3018.1	0.0012	0.0047	838.1	213.240	316.4	76.0	392.3	1.3657	1.5853	74
75	3181.9	3084.7	0.0012	0.0045	826.3	221.720	318.6	73.2	391.7	1.3718	1.5828	75
76	3247.5	3152.7	0.0012	0.0043	813.8	230.860	320.8	70.3	391.1	1.3781	1.5801	76
77	3314.2	3222.0	0.0012	0.0042	800.5	240.780	323.2	67.2	390.3	1.3846	1.5771	77
78	3381.9	3292.8	0.0013	0.0040	786.1	251.630	325.6	63.8	389.4	1.3913	1.5737	78
79	3450.8	3365.2	0.0013	0.0038	770.5	263.640	328.2	60.2	388.4	1.3984	1.5699	79

Table 1 (continued)
DuPont™ ISCEON® MO59 (R-417A) Saturation Properties—Temperature Table

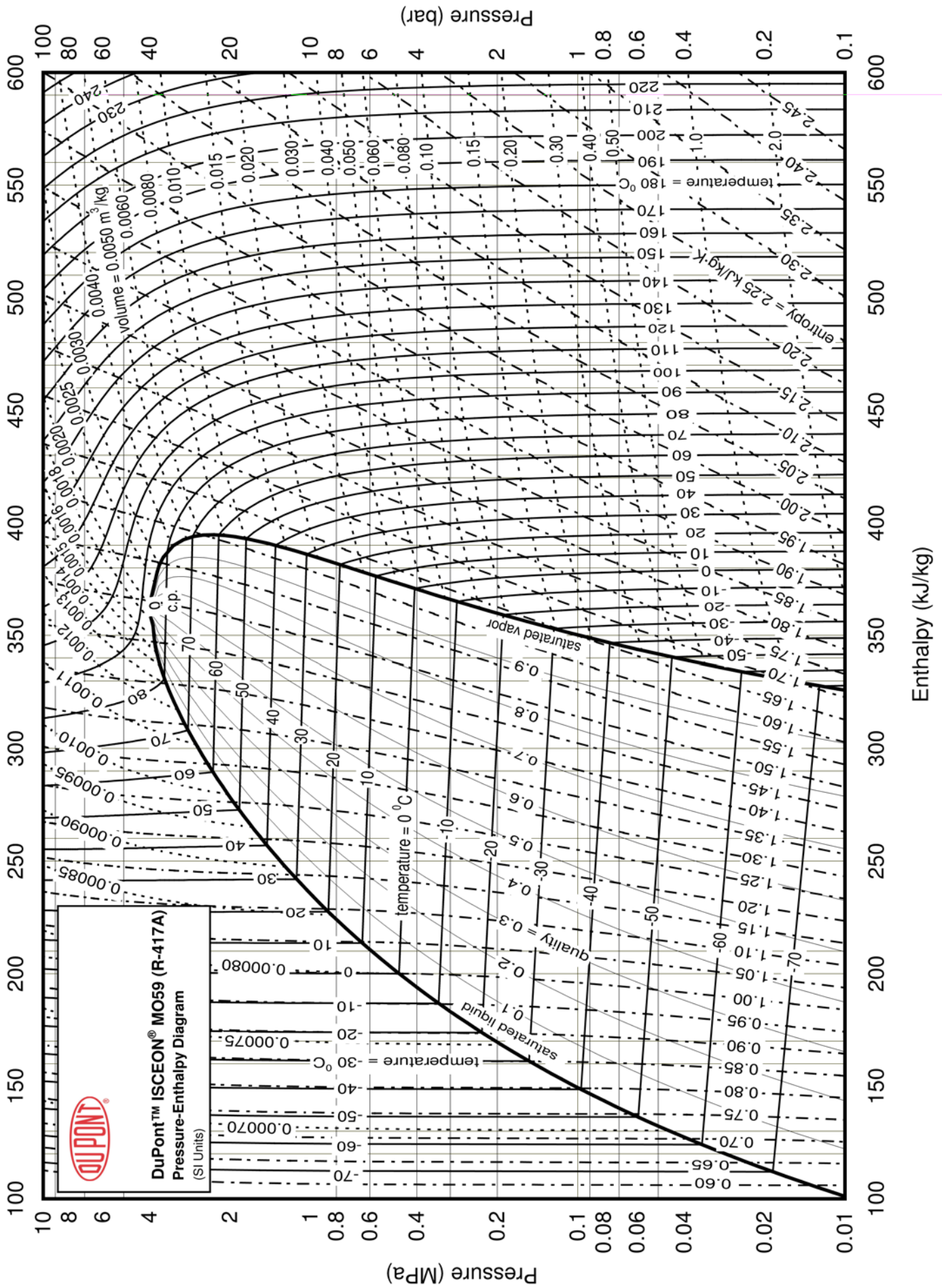
TEMP. °C	PRESSURE (kPa)		VOLUME (m ³ /kg)		DENSITY (kg/m ³)		ENTHALPY (kJ/kg)			ENTROPY (kJ/K·kg)		TEMP. °C
	LIQUID	VAPOUR	LIQUID v _l	VAPOUR v _g	LIQUID d _l	VAPOUR d _g	LIQUID h _l	LATENT h _{lg}	VAPOUR h _g	LIQUID s _l	VAPOUR s _g	
80	3520.7	3439.2	0.0013	0.0036	753.2	277.130	330.9	56.2	387.1	1.4058	1.5656	80
81	3591.6	3515.1	0.0014	0.0034	733.7	292.560	333.8	51.8	385.6	1.4138	1.5606	81
82	3663.4	3593.1	0.0014	0.0032	711.1	310.740	337.0	46.7	383.7	1.4226	1.5545	82
83	3736.0	3673.6	0.0015	0.0030	683.4	333.210	340.7	40.6	381.3	1.4327	1.5470	83
84	3808.7	3757.5	0.0015	0.0027	645.7	363.680	345.4	32.4	377.8	1.4454	1.5365	84
85	3877.7	3848.5	0.0017	0.0024	575.5	418.590	353.3	18.0	371.3	1.4672	1.5175	85

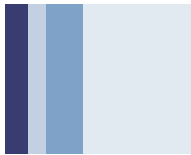
Table 2 (continued)
DuPont™ ISCEON® MO59 (R-417A) Superheated Vapour—Constant Pressure Tables

V = Volume in m³/kg H = Enthalpy in kJ/kg S = Entropy in kJ/kg·K (Saturation Properties in parentheses)

ABSOLUTE PRESSURE, kPa													
TEMP. °C	2400			2600			2800			3000			TEMP. °C
	(63.69°C)			(67.25°C)			(70.58°C)			(73.72°C)			
	V	H	S	V	H	S	V	H	S	V	H	S	
	(0.0067)	(394.7)	(1.6024)	(0.0060)	(394.4)	(1.5978)	(0.0053)	(393.7)	(1.5924)	(0.0047)	(392.4)	(1.586)	
60	—	—	—	—	—	—	—	—	—	—	—	—	60
65	0.0068	396.9	1.6091	—	—	—	—	—	—	—	—	—	65
70	0.0073	404.9	1.6324	0.0063	399.5	1.6127	—	—	—	—	—	—	70
75	0.0078	412.1	1.6532	0.0067	407.7	1.6364	0.0058	402.4	1.6177	0.0049	395.6	1.5950	75
80	0.0081	418.9	1.6726	0.0072	415.1	1.6575	0.0063	410.7	1.6415	0.0055	405.7	1.6238	80
85	0.0085	425.4	1.6909	0.0075	422.0	1.6770	0.0067	418.3	1.6627	0.0059	414.1	1.6475	85
90	0.0088	431.7	1.7084	0.0079	428.6	1.6954	0.0070	425.3	1.6822	0.0063	421.7	1.6687	90
95	0.0092	437.8	1.7252	0.0082	435.0	1.7130	0.0073	432.1	1.7007	0.0066	428.9	1.6883	95
100	0.0095	443.9	1.7416	0.0085	441.3	1.7299	0.0076	438.6	1.7183	0.0069	435.7	1.7067	100
105	0.0097	449.9	1.7575	0.0088	447.5	1.7463	0.0079	445.0	1.7352	0.0072	442.3	1.7243	105
110	0.0100	455.8	1.7730	0.0090	453.5	1.7622	0.0082	451.2	1.7517	0.0074	448.8	1.7412	110
115	0.0103	461.6	1.7882	0.0093	459.5	1.7778	0.0084	457.4	1.7676	0.0077	455.1	1.7576	115
120	0.0106	467.5	1.8032	0.0096	465.5	1.7930	0.0087	463.5	1.7832	0.0079	461.3	1.7736	120
125	0.0108	473.3	1.8178	0.0098	471.4	1.8080	0.0089	469.5	1.7984	0.0082	467.5	1.7891	125
130	0.0111	479.1	1.8323	0.0100	477.3	1.8227	0.0092	475.5	1.8134	0.0084	473.6	1.8044	130
135	0.0113	484.9	1.8466	0.0103	483.2	1.8371	0.0094	481.4	1.8280	0.0086	479.6	1.8193	135
140	0.0115	490.6	1.8606	0.0105	489.0	1.8514	0.0096	487.4	1.8425	0.0088	485.7	1.8339	140
145	0.0118	496.4	1.8745	0.0107	494.9	1.8654	0.0098	493.3	1.8567	0.0090	491.7	1.8484	145
150	0.0120	502.2	1.8882	0.0109	500.7	1.8793	0.0100	499.2	1.8708	0.0092	497.6	1.8626	150
155	0.0122	508.0	1.9018	0.0112	506.5	1.8930	0.0102	505.1	1.8846	0.0094	503.6	1.8766	155
160	0.0125	513.7	1.9152	0.0114	512.4	1.9066	0.0104	511.0	1.8983	0.0096	509.6	1.8904	160
165	0.0127	519.5	1.9285	0.0116	518.2	1.9200	0.0106	516.9	1.9119	0.0098	515.5	1.9041	165
170	0.0129	525.3	1.9417	0.0118	524.1	1.9333	0.0108	522.8	1.9253	0.0100	521.5	1.9176	170
175	0.0131	531.2	1.9547	0.0120	529.9	1.9464	0.0110	528.7	1.9385	0.0102	527.4	1.9310	175
180	0.0133	537.0	1.9677	0.0122	535.8	1.9594	0.0112	534.6	1.9516	0.0104	533.4	1.9442	180
185	0.0135	542.8	1.9805	0.0124	541.7	1.9724	0.0114	540.5	1.9647	0.0106	539.4	1.9573	185
190	0.0137	548.7	1.9933	0.0126	547.6	1.9852	0.0116	546.5	1.9776	0.0107	545.4	1.9703	190
195	0.0140	554.6	2.0059	0.0128	553.5	1.9979	0.0118	552.4	1.9903	0.0109	551.3	1.9832	195

ABSOLUTE PRESSURE, kPa													
TEMP. °C	3200			3400			3600						TEMP. °C
	(76.69°C)			(79.47°C)			(82.09°C)						
	V	H	S	V	H	S	V	H	S				
	(-0.0042)	(390.6)	(1.5781)	(0.0037)	(387.8)	(1.5680)	(0.0032)	(383.6)	(1.5540)				
75	—	—	—	—	—	—	—	—	—				75
80	0.0047	399.3	1.6029	0.0038	389.9	1.5739	—	—	—				80
85	0.0052	409.3	1.6310	0.0045	403.5	1.6120	0.0038	395.6	1.5879				85
90	0.0056	417.8	1.6545	0.0049	413.2	1.6391	0.0043	407.9	1.6219				90
95	0.0059	425.4	1.6755	0.0053	421.7	1.6621	0.0048	417.4	1.6479				95
100	0.0062	432.7	1.6950	0.0056	429.4	1.6829	0.0051	425.8	1.6705				100
105	0.0065	439.6	1.7133	0.0059	436.6	1.7023	0.0054	433.5	1.6910				105
110	0.0068	446.2	1.7309	0.0062	443.6	1.7205	0.0057	440.8	1.7101				110
115	0.0070	452.8	1.7478	0.0064	450.3	1.7380	0.0059	447.7	1.7282				115
120	0.0073	459.2	1.7641	0.0067	456.9	1.7548	0.0062	454.5	1.7456				120
125	0.0075	465.4	1.7801	0.0069	463.3	1.7711	0.0064	461.1	1.7623				125
130	0.0077	471.7	1.7956	0.0071	469.7	1.7870	0.0066	467.6	1.7785				130
135	0.0079	477.8	1.8108	0.0073	476.0	1.8024	0.0068	474.0	1.7943				135
140	0.0081	483.9	1.8257	0.0075	482.2	1.8176	0.0070	480.4	1.8097				140
145	0.0083	490.0	1.8403	0.0077	488.4	1.8324	0.0072	486.6	1.8248				145
150	0.0085	496.1	1.8547	0.0079	494.5	1.8470	0.0074	492.9	1.8396				150
155	0.0087	502.1	1.8689	0.0081	500.6	1.8614	0.0076	499.1	1.8541				155
160	0.0089	508.1	1.8829	0.0083	506.7	1.8755	0.0077	505.2	1.8684				160
165	0.0091	514.2	1.8967	0.0085	512.8	1.8895	0.0079	511.4	1.8825				165
170	0.0093	520.2	1.9103	0.0087	518.8	1.9032	0.0081	517.5	1.8964				170
175	0.0095	526.2	1.9238	0.0088	524.9	1.9168	0.0083	523.6	1.9101				175
180	0.0096	532.2	1.9371	0.0090	530.9	1.9303	0.0084	529.7	1.9237				180
185	0.0098	538.2	1.9503	0.0092	537.0	1.9436	0.0086	535.8	1.9371				185
190	0.0100	544.2	1.9634	0.0093	543.1	1.9567	0.0087	541.9	1.9504				190
195	0.0102	550.2	1.9763	0.0095	549.1	1.9698	0.0089	548.0	1.9635				195





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