SPORLAN

PRESSURE-TEMPERATURE CHART

at Altitude – 5,000 feet above Sea Level

PSIG	TEMPERATURE °F									
	REFRIGERANT - (SPORLAN CODE)									
	22 (V)	134a (J)	404A (S)		407A (N)		407C (N)		407F (N)	
			Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point
5*	-56	-30	-66	-64	-64	-52	-61	-48	-65	-54
4*	-55	-29	-64	-63	-62	-50	-59	-47	-64	-52
3*	-53	-27	-63	-61	-60	-48	-58	-45	-62	-50
2*	-51	-25	-61	-60	-59	-47	-56	-44	-61	-49
1*	-50	-24	-59	-58	-57	-45	-55	-42	-59	-47
0	-48	-22	-58	-57	-56	-44	-53	-41	-58	-46
1	-46	-19	-55	-54	-53	-41	-50	-38	-55	-43
2	-43	-16	-52	-51	-50	-39	-48	-35	-52	-41
3	-40	-14	-50	-49	-48	-36	-45	-33	-50	-38
4	-38	-11	-47	-46	-45	-34	-43	-30	-47	-36
5	-35	-9	-45	-44	-43	-32	-41	-28	-45	-34
6	-33	-6	-43	-42	-41	-29	-38	-26	-43	-31
7	-31	-4	-41	-40	-39	-27	-36	-24	-41	-29
8	-29	-2	-39	-38	-37	-25	-34	-22	-39	-27
9	-27	0	-37	-36	-35	-24	-32	-20	-37	-26
10	-25	2	-35	-34	-33	-22	-30	-18	-35	-24
11	-23	4	-33	-32	-31	-20	-29	-16	-33	-22
12	-21	6	-31	-30	-29	-18	-27	-15	-32	-20
13	-19	8	-30	-28	-28	-17	-25	-13	-30	-19
14	-18	9	-28	-27	-26	-15	-24	-11	-28	-17
15	-16	11	-26	-25	-25	-13	-22	-10	-27	-16
16	-15	13	-25	-24	-23	-12	-20	-8	-25	-14
17	-13	14	-23	-22	-22	-11	-19	-7	-24	-13
18	-12	16	-22	-21	-20	-9	-17	-5	-22	-11
19	-10	17	-20	-19	-19	-8	-16	-4	-21	-10
20	-9	19	-19	-18	-17	-6	-15	-3	-19	-8
21	-7	20	-18	-17	-16	-5	-13	-1	-18	-7
22	-6	22	-16	-15	-15	-4	-12	0	-17	-6
23	-4	23	-15	-14	-13	-2	-11	1	-16	-5
24	-3	24	-14	-13	-12	-1	-9	3	-14	-3
25	-2	26	-13	-11	-11	0	-8	4	-13	-2
26	-1	27	-11	-10	-10	1	-7	5	-12	-1
27	1	28	-10	-9	-8	2	-6	6	-11	0
28	2	29	-9	-8	-7	4	-4	7	-9	1
29	3	31	-8	-7	-6	5	-3	9	-8	2
30	4	32	-7	-5	-5	6	-2	10	-7	4
31	5	33	-5	-4	-4	7	-1	11	-6	5
32	6	34	-4	-3	-3	8	0	12	-5	6
33	8	35	-3	-2	-2	9	1	13	-4	7
34	9	36	-2	-1	-1	10	2	14	-3	8
35	10	37	-1	0	0	11	3	15	-2	9
36	11	38	0	1	1	12	4	16	-1	10
37	12	40	1	2	2	13	5	17	0	11
38	13	41	2	3	3	14	6	18	1	12
39	14	42	3	4	4	15	7	19	2	13
40	15	43	4	5	5	16	8	20	3	13
42	17	45	6	7	7	18	10	22	5	15
44	19	46	8	9	9	19	12	23	7	17
46	20	48	9	10	11	21	14	25	8	19
48	22	50	11	12	12	23	15	27	10	20
50	24	52	13	14	14	24	17	28	12	22
52	26	54	14	15	16	26	19	30	13	24
54	27	55	16	17	17	28	20	32	15	25
56	29	57	18	19	19	29	22	33	16	27
58	31	59	19	20	20	31	23	35	18	28
60	32	60	21	22	22	32	25	36	19	30
62	34	62	22	23	23	33	26	38	21	31
64	35	63	24	25	25	35	28	39	22	32
66	37	65	25	26	26	36	29	40	24	34
68	38	66	27	27	28	38	31	42	25	35
70	39	68	28	29	29	39	32	43	26	36
72	41	69	29	30	30	40	33	44	28	38
74	42	70	31	32	31	41	35	46	29	39
76	43	72	32	33	33	43	36	47	30	40
78	45	73	33	34	34	44	37	48	31	41
80	46	74	34	35	35	45	38	49	33	43
85	49	78	37	38	38	48	41	52	36	45
90	52	81	40	41	41	51	44	55	38	48
95	55	83	43	44	44	54	47	58	41	51
100	58	86	46	47	47	56	50	60	44	54
105	61	89	49	49	49	59	52	63	46	56
110	63	92	51	52	52	61	55	65	49	59
115	66	94	54	55	54	64	57	68	51	61
120	68	97	56	57	57	66	60	70	54	63
125	71	99	58	59	59	68	62	72	56	65
130	73	102	61	62	61	70	64	75	58	68
135	75	104	63	64	63	72	67	77	60	70
140	77	106	65	66	65	74	69	79	63	72
145	80	108	67	68	68	77	71	81	65	74
150	82	110	69	70	70	78	73	83	67	76
155	84	113	71	72	72	80	75	85	69	78
160	86	115	73	74	73	82	77	87	70	79
165	88	117	75	76	75	84	79	89	72	81
170	90	119	77	78	77	86	81	90	74	83
175	92	121	79	80	79	88	83	92	76	85
180	93	122	81	82	81	89	84	94	78	87
185	95	124	83	83	83	91	86	96	80	88
190	97	126	84	85	84	93	88	97	81	90
195	99	128	86	87	86	94	90	99	83	91
200	101	130	88	88	88	96	91	100	85	93
205	102	131	89	90	89	98	93	102	86	95
210	104	133	91	92	91	99	94.4	104	88	96
220	107	136	94	95	94	102	97.6	107	91	99
230	110	139	97	98	97	105	101	110	94	102
240	113	143	100	101	100	108	104	112	97	105
250	116	146	103	104	103	111	106	115	100	108
260	119	148	106	107	106	113	109	118	102	110
275	124	153	110	111	110	117	113	122	106	114
290	128	157	114	114	114	121	117	125	110	118
305	131	161	118	118	117	124	121	129	114	121
320	135	164	121	122	121	128	125	132	117	125
335	139	168	125	125	124	131	128	136	121	128
350	142	172	128	129	128	134	132	139	124	131
365	146	175	131	132	131	137	135	142	127	134
380	149	178	135	135	134	140	138	145	131	137
400	153	183	139	139	138	144	142	149	135	141
420	157	187	143	143	142	148	146	153	138	145
440	161	191	146	147	146	152	150	156	142	148
460	165	194	150	150	150	155	154	160	146	152
480	169	198	154	154	153	158	157	163	149	155
500	173	202	157	157	157	162	161	166	153	158

* Inches mercury below one atmosphere

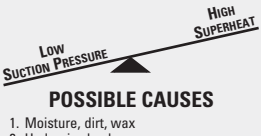
MAKE A SYSTEMATIC ANALYSIS

Based on the complaint and measurements taken

Changing Parts Might Be The First Reaction
BUT...
1. May not be necessary and...
2. Does not always solve the problem

SUPERHEAT AND SUCTION PRESSURE

symptoms can provide the real cause

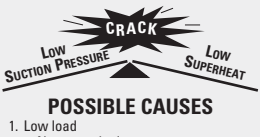


POSSIBLE CAUSES

1. Moisture, dirt, wax
2. Undersized valve
3. High superheat adjustment
4. Gas charge condensation
5. Dead thermostatic element charge
6. Wrong thermostatic charge
7. Evaporator pressure drop — no external equalizer
8. External equalizer location
9. Restricted or capped external equalizer
10. Low refrigerant charge
11. Liquid line vapor
    a. Vertical lift
    b. High friction loss
    c. Long or small line
    d. Plugged drier or strainer
12. Low pressure drop across valve
    a. Same as #11 above
    b. Undersized distributor nozzle or circuits
    c. Low condensing temperature

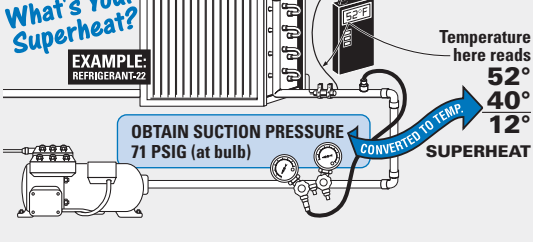
POSSIBLE CAUSES

1. Oversized valve
2. TEV seat leak
3. Low superheat adjustment
4. Bulb installation
   a. Poor thermal contact
   b. Warm location
5. Wrong thermostatic charge
6. Bad compressor – low capacity
7. Moisture, dirt, wax
8. Incorrectly located external equalizer



POSSIBLE CAUSES

1. Low load
   a. Not enough air
   b. Dirty air filters
   c. Air too cold
   d. Coil icing
2. Poor air distribution
3. Poor refrigerant distribution
4. Improper compressor-evaporator balance
5. Evaporator oil logged
6. Flow from one TEV affecting another's bulb



SPORLAN

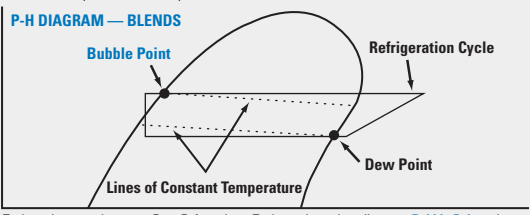
PRESSURE-TEMPERATURE CHART

at Altitude – 5,000 feet above Sea Level

PSIG	TEMPERATURE °F — REFRIGERANT - (SPORLAN CODE)									
	410A (Z)	438A (V)		448A (D)		449A (D)		507A (S)	513A (J)	
		Bubble Point	Dew Point	Bubble Point	Dew Point	Bubble Point	Dew Point		
5*	-74	-59	-48	-66	-54	-65	-54	-67	-37	
4*	-73	-57	-46	-64	-53	-63	-53	-65	-35	
3*	-71	-56	-44	-62	-51	-62	-51	-63	-33	
2*	-70	-54	-43	-61	-49	-60	-50	-62	-32	
1*	-68	-53	-41	-59	-48	-58	-48	-60	-30	
0	-67	-51	-40	-58	-47	-57	-47	-59	-29	
1	-64	-48	-37	-55	-44	-54	-44	-56	-25	
2	-62	-45	-34	-52	-41	-52	-41	-53	-23	
3	-59	-43	-32	-50	-39	-49	-39	-51	-20	
4	-57	-40	-29	-47	-36	-47	-36	-48	-17	
5	-55	-38	-27	-45	-34	-44	-34	-46	-15	
6	-53	-36	-25	-43	-32	-42	-32	-44	-12	
7	-51	-34	-23	-41	-30	-40	-30	-42	-10	
8	-49	-32	-21	-39	-28	-38	-28	-40	-8	
9	-47	-30	-19	-37	-26	-36	-26	-38	-6	
10	-45	-28	-17	-35	-24	-34	-24	-36	-4	
11	-44	-26	-15	-33	-22	-32	-22	-34	-2	
12	-42	-24	-13	-31	-21	-31	-21	-32	0	
13	-40	-22	-12	-30	-19	-29	-19	-31	2	
14	-39	-21	-10	-28	-17	-27	-17	-29	3	
15	-37	-19	-9	-27	-16	-26	-16	-27	5	
16	-36	-18	-7	-25	-14	-24	-14	-26	7	
17	-34	-16	-6	-24	-13	-23	-13	-24	8	
18	-33	-15	-4	-22	-11	-21	-11	-23	10	
19	-32	-13	-3	-21	-10	-20	-10	-22	12	
20	-30	-12	-1	-19	-8	-19	-8	-20	13	
21	-29	-10	0	-18	-7	-17	-7	-19	15	
22	-28	-9	1	-17	-6	-16	-6	-17	16	
23	-27	-8	3	-15	-5	-15	-5	-16	17	
24	-25	-6	4	-14	-3	-13	-3	-15	19	
25	-24	-5	5	-13	-2	-12	-2	-14	20	
26	-23	-4	6	-12	-1	-11	-1	-12	21	
27	-22	-3	8	-10	0	-10	0	-11	23	
28	-21	-2	9	-9	1	-8	1	-10	24	
29	-20	0	10	-8	3	-7	3	-9	25	
30	-19	1	11	-7	4	-6	4	-8	26	
31	-18	2	12	-6	5	-5	5	-7	28	
32	-17	3	13	-5	6	-4	6	-5	29	
33	-16	4	14	-4	7	-3	7	-4	30	
34	-15	5	15	-3	8	-2	8	-3	31	
35	-14	6	16	-2	9	-1	9	-2	32	
36	-13	7	17	-1	10	0	10	-1	33	
37	-12	8	18	0	11	1	11	0	34	
38	-11	9	19	1	12	2	12	1	35	
39	-10	10	20	2	13	3	13	2	36	
40	-9	11	21	3	14	4	14	3	37	
42	-7	13	23	5	16	6	16	5	39	
44	-6	15	25	7	17	8	18	6	41	
46	-4	17	27	9	19	10	19	8	43	
48	-2	19	28	10	21	11	21	10	45	
50	-1	20	30	12	23	13	23	12	47	
52	1	22	32	14	24	15	24	13	49	
54	2	24	33	15	26	16	26	15	50	
56	4	25	35	17	27	18	27	16	52	
58	5	27	36	18	29	19	29	18	54	
60	7	28	38	20	30	21	30	19	55	
62	8	30	39	21	32	22	32	21	57	
64	9	31	41	23	33	24	33	22	59	
66	11	33	42	24	34	25	35	24	60	
68	12	34	44	26	36	26	36	25	62	
70	13	35	45	27	37	28	37	27	63	
72	15	37	46	28	38	29	39	28	64	
74	16	38	47	30	40	30	40	29	66	
76	17	39	49	31	41	32	41	31	67	
78	18	41	50	32	42	33	42	32	69	
80	19	42	51	33	43	34	44	33	70	
85	22	45	54	36	46	37	47	36	73	
90	25	48	57	39	49	40	49	39	76	
95	28	51	60	42	52	43	52	42	79	
100	30	54	63	45	55	46	55	45	82	
105	33	56	65	47	57	48	57	47	85	
110	35	59	68	50	60	51	60	50	88	
115	37	61	70	52	62	53	62	52	90	
120	39	64	72	55	64	56	65	55	93	
125	42	66	75	57	67	58	67	57	95	
130	44	68	77	59	69	60	69	59	98	
135	46	71	79	61	71	62	71	61	100	
140	48	73	81	64	73	65	73	64	102	
145	50	75	83	66	75	67	75	66	105	
150	52	77	85	68	77	69	77	68	107	
155	54	79	87	70	79	71	79	70	109	
160	55	81	89	72	81	73	81	72	111	
165	57	83	91	74	83	75	83	74	113	
170	59	85	93	75	85	76	85	76	115	
175	61	87	95	77	86	78	87	77	117	
180	62	89	97	79	88	80	88	79	119	
185	64	90	98	81	90	82	90	81	121	
190	66	92	100	83	92	84	92	83	123	
195	67	94	102	84	93	85	94	84	125	
200	69	96	103	86	95	87	95	86	127	
205	70	97	105	88	96	89	97	88	128	
210	72	99	107	89	98	90	98	89	130	
220	75	102	110	92	101	93	101	93	133	
230	78	105	113	95	104	96	104	96	137	
240	80	108	116	98	107	99	107	99	140	
250	83	111	118	101	110	102	110	102	143	
260	86	114	121	104	112	105	113	104	146	
275	89	118	125	108	116	109	117	108	150	
290	93	122	129	112	120	113	120	112	154	
305	96	126	133	116	123	117	124	116	158	
320	100	130	136	119	127	120	127	120	162	
335	103	133	139	123	130	124	131	123	166	
350	106	137	143	126	133	127	134	126	169	
365	109	140	146	129	137	130	137	130	173	
380	112	143	149	133	140	134	140	133	176	
400	116	148	152	137	144	138	144	137	181	
420	120	152	157	141	147	142	148	141	185	
440	123	156	160	145	151	146	151	145	189	
460	127	159	164	148	154	149	155	148	193	
480	130	163	167	152	158	153	158	152	196	
500	133	167	170	155	161	157	161	155	200	

* Inches mercury below one atmosphere

P-H DIAGRAM — BLENDS



To detemine superheat, use **Dew Point** values. To determine subcooling, use **Bubble Point** values.

APPROXIMATE PRESSURE CONTROL SETTINGS

at Altitude - 5,000 Feet above Sea Level

Pressure - Pounds Per Square Inch Gauge

APPLICATION	TEMPERATURE RANGE (°F)	EVAPORATOR TD (°F)	REFRIGERANT							
			22		134a		404A		507	
			Out	In	Out	In	Out	In	Out	In
Beverage Cooler	35 to 38	15	43	68	20	36	54	85	57	89
Floral Cooler										
Produce Cooler										
Smoked Meat Cooler	32 to 35	15	40	64	18	33	52	80	55	84
Meat Reach Thru										
Service Deli										
Seafood										
Multi-Deck Fresh Meat	26 to 29	15	34	56	14	28	45	71	47	74
Frozen Glass Door	-10 to 0	10	12	26	-	-	17	35	19	38
Frozen Walk-In										
Frozen Ice Cream	-30 to -20	10	2	13	-	-	6	19	7	20
Frozen Food - Open Type										

Pressure control settings assume a suction line pressure loss equivalent to 2°F.

CARRYING CAPACITY OF REFRIGERATION LINES

Tons of Refrigeration - 200 Feet Equivalent Pipe Length

TYPE L COPPER TUBE O.D. Inches	REFRIGERANT									
	22		134a		404A / 507		R407A		R448A / R449A	
	Liquid Line	Suction Line	Liquid Line	Suction Line	Liquid Line	Suction Line	Liquid Line	Suction Line	Liquid Line	Suction Line
	20°F Evap.		20°F Evap.		-20°F Evap.		20°F Evap.		-20°F Evap.	
3/8	0.99	0.09	0.73	0.06	0.71	0.04	1.01	0.07	0.93	0.03
1/2	2.37	0.23	1.77	0.13	1.71	0.10	2.42	0.18	2.23	0.07
5/8	4.48	0.43	3.36	0.25	3.23	0.18	4.57	0.33	4.2	0.13
7/8	11.9	1.13	8.97	0.67	8.58	0.49	12.1	0.88	11.1	0.36
1-1/8	24.3	2.30	18.3	1.36	17.5	0.99	24.6	1.79	22.55	0.73
1-3/8	42.6	4.02	32.2	2.38	30.6	1.74	42.9	3.14	39.35	1.3
1-5/8	67.6	6.37	51.1	3.78	48.4	2.76	67.9	4.97	62.25	2.05
2-1/8	141	13.2	107	7.88	101	5.74	141	10.3	129.5	4.27
2-5/8	250	23.4	190	14.0	179	10.2	249	18.3	228.5	7.57
3-1/8	400	37.5	304	22.4	286	16.3	398	29.2	365	12.15
3-5/8	595	55.7	453	33.3	425	24.2	592	43.4	542	18.05
4-1/8	841	78.7	641	47.0	600	34.2	835	61.2	764	25.5

Refrigerants 22, 134a, 404A, and 507 values are based on 100°F liquid temperature and the stated evaporator temperature. Both suction and liquid line values are based on a pressure drop equivalent to 1°F change in saturation temperature. For additional information on refrigerant line sizing, consult ASHRAE's Refrigeration Handbook or equipment manufacturer.

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