

# Refrigerant Equations / Diagnostics



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### REFRIGERANT STATE EQUATIONS

Superheat = Actual Suction Line Temperature - Refrigerant Saturation Temperature  
 Subcooling = Refrigerant Saturation Temperature - Actual Liquid Line Temperature

### TEMPERATURE CONVERSIONS

$$T^{\circ}F = 1.8 \times (C^{\circ}) + 32 \quad C^{\circ} = (F - 32) / 1.8$$

### ELECTRIC HEAT EQUATIONS

$$Q_s = 1.08 \times CFM \times TD \quad CFM = Q_s / 1.08 \times TD$$

$$BTUH = Watts \times 3.413 \quad Watts = BTUH / 3.413$$

### OHM'S LAW

$$P = I \times E$$

$$P = E^2 / R$$

$$P = I^2 \times R$$

Where:

$$E = I \times R$$

$$I = E / R$$

$$R = E / I$$

$Q_s$  = Sensible Heat in BTUH  
 TD = Temperature Difference  
 CFM = Cubic Feet per Minute  
 BTUH = British Thermal Units per Hour  
 P = Watts  
 E = Voltage  
 I = Current  
 R = Resistance

### DIAGNOSTIC TABLE

SYMPTOMS	HP	SP	SH	SC	A	TD
Undercharge	↓	↓	↑	↓	↓	↓
Overcharge	↑	↑	↓	↑	↑	↓
Restriction	↓	↓	↑	↑	↓	↑
Low Indoor Air Flow	↓	↓	↓	↑	↓	↑
Dirty Condenser	↑	↑	↓	↓	↑	↓
High Indoor Ambient	↑	↑	↑	↓	↑	↓
Inefficient Compressor	↓	↑	↑	↓	↓	↓
Air in System	↑	↑	↓	↓	↑	↓

HP = Head Pressure  
 SH = Superheat  
 A = Amps  
 SP = Suction Pressure  
 SC = Subcool  
 TD = Temperature Difference

### Common H/P Thermostat

Function	Terminal
24VAC from Transformer	R
24VAC Common	X or C
Indoor Blower Relay	G
Compressor Contactor	Y
N/A	W
2 <sup>nd</sup> Stage Heat	W <sub>2</sub>
4-Way Valve (energized in cooling)	O
4-Way Valve (energized in heating)	B
Emergency Heat	E

### Common A/C Thermostat

Function
24VAC from Transformer
24VAC Common
Indoor Blower Relay
Compressor Contactor
1 <sup>st</sup> Stage Heat
2 <sup>nd</sup> Stage Heat
N/A
N/A
N/A

We Encourage Professionalism



Through Technician Certification by NATE

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(°F)	PSIG R410-A	R22	(°F)	PSIG R410-A	R22	(°F)	PSIG R410-A	R22
-40	10.8	0.6	25	87.2	48.8	90	273.5	168.4
-39	11.5	1.0	26	89.1	50.0	91	277.6	171.0
-38	12.1	1.4	27	91.0	51.2	92	281.7	173.7
-37	12.8	1.8	28	92.9	52.4	93	285.9	176.4
-36	13.5	2.2	29	94.9	53.7	94	290.1	179.1
-35	14.2	2.6	30	96.8	55.0	95	294.4	181.8
-34	14.9	3.1	31	98.8	56.2	96	298.7	184.6
-33	15.6	3.5	32	100.9	57.5	97	303.0	187.4
-32	16.3	4.0	33	102.9	58.8	98	307.5	190.2
-31	17.1	4.5	34	105.0	60.2	99	311.9	193.0
-30	17.8	4.9	35	107.1	61.5	100	316.4	195.9
-29	18.6	5.4	36	109.2	62.9	101	321.0	198.8
-28	19.4	5.9	37	111.4	64.3	102	325.6	201.8
-27	20.2	6.4	38	113.6	65.7	103	330.2	204.7
-26	21.1	6.9	39	115.8	67.1	104	334.9	207.7
-25	21.9	7.4	40	118.1	68.6	105	339.6	210.8
-24	22.7	8.0	41	120.3	70.0	106	344.4	213.8
-23	23.6	8.5	42	122.7	71.5	107	349.3	216.9
-22	24.5	9.1	43	125.0	73.0	108	354.2	220.0
-21	25.4	9.6	44	127.4	74.5	109	359.1	223.2
-20	26.3	10.2	45	129.8	76.1	110	364.1	226.4
-19	27.2	10.8	46	132.2	77.6	111	369.1	229.6
-18	28.2	11.4	47	134.7	79.2	112	374.2	232.8
-17	29.2	12.0	48	137.2	80.8	113	379.4	236.1
-16	30.1	12.6	49	139.7	82.4	114	384.6	239.4
-15	31.1	13.2	50	142.2	84.1	115	389.9	242.8
-14	32.2	13.9	51	144.8	85.7	116	395.2	246.1
-13	33.2	14.5	52	147.4	87.4	117	400.5	249.5
-12	34.2	15.2	53	150.1	89.1	118	405.9	253.0
-11	35.3	15.9	54	152.8	90.8	119	411.4	256.5
-10	36.4	16.5	55	155.5	92.6	120	416.9	260.0
-9	37.5	17.2	56	158.2	94.4	121	422.5	263.5
-8	38.6	17.9	57	161.0	96.1	122	428.2	267.1
-7	39.8	18.7	58	163.8	98.0	123	433.9	270.7
-6	40.9	19.4	59	166.7	99.8	124	439.6	274.3
-5	42.1	20.1	60	169.6	101.6	125	445.4	278.0
-4	43.3	20.9	61	172.5	103.5	126	451.3	281.7
-3	44.5	21.7	62	175.4	105.4	127	457.3	285.4
-2	45.7	22.4	63	178.4	107.3	128	463.2	289.2
-1	47.0	23.2	64	181.5	109.3	129	469.3	293.0
0	48.3	24.0	65	184.5	111.2	130	475.4	296.9
1	49.6	24.9	66	187.6	113.2	131	481.6	300.8
2	50.9	25.7	67	190.7	115.3	132	487.8	304.7
3	52.2	26.5	68	193.9	117.3	133	494.1	308.7
4	53.6	27.4	69	197.1	119.4	134	500.5	312.6
5	55.0	28.3	70	200.4	121.4	135	506.9	316.7
6	56.3	29.2	71	203.6	123.5	136	513.4	320.7
7	57.8	30.1	72	207.0	125.7	137	520.0	324.8
8	59.2	31.0	73	210.3	127.8	138	526.6	329.0
9	60.7	31.9	74	213.7	130.0	139	533.3	333.2
10	62.2	32.8	75	217.1	132.2	140	540.1	337.4
11	63.7	33.8	76	220.6	134.5	141	547.0	341.6
12	65.2	34.8	77	224.1	136.7	142	553.9	345.9
13	66.8	35.8	78	227.7	139.0	143	560.9	350.3
14	68.3	36.8	79	231.3	141.3	144	567.9	354.6
15	69.9	37.8	80	234.9	143.6	145	575.1	359.0
16	71.5	38.8	81	238.6	146.0	146	582.3	363.5
17	73.2	39.9	82	242.3	148.4	147	589.6	368.0
18	74.9	40.9	83	246.0	150.8	148	596.9	372.5
19	76.6	42.0	84	249.8	153.2	149	604.4	377.1
20	78.3	43.1	85	253.7	155.7	150	611.9	381.7
21	80.0	44.2	86	257.5	158.2			
22	81.8	45.3	87	261.4	160.7			
23	83.6	46.5	88	265.4	163.2			
24	85.4	47.6	89	269.4	165.8			