

# SYSTEM ANALYZER

DATE: \_\_\_\_\_ CUSTOMER NAME: \_\_\_\_\_

TECHNICIAN: \_\_\_\_\_ ADDRESS: \_\_\_\_\_

COMPANY: \_\_\_\_\_

PHONE: \_\_\_\_\_ PHONE: \_\_\_\_\_

**REASON FOR SERVICE CALL:**

- |  |   |  |
|--|---|--|
| <input type="checkbox"/> SCHEDULED MAINTENANCE | <input type="checkbox"/> LOW (NO) HEATING   | <input type="checkbox"/> NOISES - ODORS    |
| <input type="checkbox"/> LOW (NO) COOLING      | <input type="checkbox"/> RAPID ON-OFF CYCLE | <input type="checkbox"/> FAULTY THERMOSTAT |
| <input type="checkbox"/> OTHER _____           | <input type="checkbox"/> SYSTEM WON'T START |  |

## BE SAFE...

Working on air conditioning, refrigeration or heating systems means working on components that are pressurized, rotating, or either thermally or electrically **HOT**. Be sure to disconnect all electrical power before working on system. Utilize all safety procedures shown is printed instructions. **Don't take chances.**

RECORD SYSTEM DATA: REFRIGERANT \_\_\_\_\_ LBS. \_\_\_\_\_ TYPE \_\_\_\_\_

**TABLE 1 - Unit Nameplate Information**

INDOOR SECTION	OUTDOOR SECTION	PISTON USED
MODEL NO. _____	MODEL NO. _____	INDOOR PISTON SIZE  OUTDOOR PISTON SIZE _____
SERIAL NO. _____	SERIAL NO. _____	
VOLTAGE _____ V _____ $\phi$	VOLTAGE _____ V _____ $\phi$	
CURRENT _____	CURRENT _____	

**MAKE VISUAL PRESTART INSPECTION (SYSTEM OFF). RECORD AND CORRECT OBVIOUS DEFECTS.**

**CAUTION: DISCONNECT MUST BE OPEN, LOCKED, AND TAGGED.**

- |   |  |   |
|---|--|---|
| <input type="checkbox"/> Check equipment log (2 SP)<br>(Fault code no. on PC board)   | <input type="checkbox"/> Air Filters - Dirty   | <input type="checkbox"/> Rust streaks - Condensate<br>(Drip/puddles)                          |
| <input type="checkbox"/> Thermostat<br>Non-functional   | <input type="checkbox"/> Blower/Fans<br><input type="checkbox"/> Dirty                             | <input type="checkbox"/> Refrigerant piping<br>Y N  |
| <input type="checkbox"/> Evaporator Coil - Dirty<br><input type="checkbox"/> TXV bulb loose/uninsulated                       | <input type="checkbox"/> Slipping<br><input type="checkbox"/> Belt tensions - loose                | <input type="checkbox"/> Well Supported<br><input type="checkbox"/> Properly sized            |
| <input type="checkbox"/> Condenser Coil - Dirty<br><input type="checkbox"/> Fin collars corroded                              | <input type="checkbox"/> Supply plenum restricted<br><input type="checkbox"/> Diffusers Restricted | <input type="checkbox"/> Buried<br><input type="checkbox"/> Too long                          |
| <input type="checkbox"/> Air restricted<br><input type="checkbox"/> Water restricted; valves<br>off - screens/filters plugged | <input type="checkbox"/> Strainer<br>Y N   | <input type="checkbox"/> Suction insulated  |
| <input type="checkbox"/> Compressor<br>Y N  | <input type="checkbox"/> Plugged   | <input type="checkbox"/> Piping accessories<br>Y N  |
| <input type="checkbox"/> Crankcase htr. ok  |  | <input type="checkbox"/> Muffler  |
| <input type="checkbox"/> Internal winding PTC (2 SP)  |  | <input type="checkbox"/> Liquid filter drier<br><input type="checkbox"/> Suction filter drier |

## START SYSTEM AND CHECK BASIC OPERATION

**CAUTION: Before starting System:**

Be sure disconnects are open, locked and tagged. Then

- Install pressure gauge manifold.  Position electrical meter alligator clip on terminals.  
(Do not attach directly to compressor terminals.)

**Start System**

Restore power.

**Voltage**

Obtain and record voltage readings of each phase in Table 2. Imbalance should not exceed 2 percent.

**Amperage**

Obtain and record amperage reading for each phase. (Imbalance should not exceed 10 percent)

**Sounds**

Listen for abnormal sounds. Check for excessive vibration of compressor, piping, motors, and fans.

**Air Flow**

Check that all fans/motors are operational and moving proper amounts of air.

**Shut system off if abnormal symptoms are noticed.**

**BEFORE PROCEEDING TO STEP 6, REVIEW TABLE 4 FOR "TYPICAL" OPERATING PRESSURES AND TEMPERATURES. THESE ARE FOR REFERENCE ONLY.**

**TABLE 2 - Compressor Electrical Data**

- Compressor Data -			
From Compressor Nameplate:	VOLTAGE	CURRENT	RESISTANCE CHECK
Type: _____	C-R _____	C-R _____	C-R _____
Model No. _____	1φ C-S _____	C-S _____	C-S _____
Serial No. _____	R-S _____	R-S _____	R-S _____
	L1-L2 _____	L1-L2 _____	L1-L2 _____
	3φ L1-L3 _____	L1-L3 _____	L1-L3 _____
	L2-L3 _____	L2-L3 _____	L2-L3 _____

**TABLE 3 System Capacity**

INDOOR COIL (EVAPORATOR)					
D.B.	ENTERING	LEAVING	DIFFERENCE		
W.B.			$\Delta T =$ °F		
ENTHALPY			$\Delta h$ Btu/LB		
* EVAPORATOR CAPACITY BTUH = 4.5 x CFM x $\Delta h$					
OUTDOOR COIL (CONDENSER)					
(AIR) D.B.	ENTERING	LEAVING	DIFFERENCE		
			$\Delta T =$ °F		
CONDENSER CAPACITY BTUH = 1.10 x COND.CFM x $\Delta t$					
* Due to varying field test conditions, a tolerance of 10% must be expected when comparing test data to actual performance.					
ENTHALPY					
Wet-bulb (F)	Btu/LB	Wet-bulb (F)	Btu/LB	Wet-bulb (F)	Btu/LB
55	23.22	65	30.06	75	38.61
56	23.84	66	30.83	76	39.57
57	24.48	67	31.62	77	40.57
58	25.12	68	32.42	78	41.58
59	25.78	69	33.25	79	42.62
60	26.46	70	34.09	80	43.69
61	27.15	71	34.95	81	44.78
62	27.85	72	35.83	82	45.90
63	28.57	73	36.74	83	47.04
64	29.31	74	37.66	81	48.22

**PRESSURE - TEMPERATURE CHART**

PSIG	R-22	R-134A	R-410A	PSIG°	R-22	R-134A	R-410A
0	-41	-15	-60	78	46	75	20
2	-37	-10	-58	80	48	76	21
4	-32	-5	-54	85	51	79	24
6	-28	-1	-50	90	54	82	26
8	-24	3	-46	95	56	85	29
10	-20	7	-42	100	59	88	32
12	-17	10	-39	105	62	90	34
14	-14	13	-36	110	64	93	36
16	-11	16	-33	115	67	96	39
18	-8	19	-30	120	69	98	41
20	-5	22	-28	125	72	100	43
22	-3	25	-26	130	74	103	45
24	0	27	-24	135	76	105	47
26	2	30	-20	140	78	107	49
28	5	32	-18	145	81	109	51
30	7	35	-16	150	83	112	53
32	9	37	-14	160	87	116	57
34	11	39	-12	170	91	120	60
36	13	41	-10	180	94	123	64
38	15	43	-8	190	98	127	67
40	17	45	-6	200	101	131	70
42	19	47	-4	210	105	134	73
44	21	49	-3	220	108	137	76
46	23	51	-2	225	110	139	78
48	24	52	0	235	113	142	80
50	26	54	1	245	116	145	83
52	28	56	3	255	119	148	85
54	29	57	4	265	121	151	88
56	31	59	6	275	124	153	90
58	32	60	7	285	127	155	92
60	34	62	8	295	130	158	95
62	35	64	10	305	133	161	97
64	37	65	11	325	137	167	101
66	38	66	13	355	144	173	108
68	40	68	14	375	148	177	112
70	41	69	15	405	155	182	118
72	42	71	16	500	173	202	134
74	44	72	17	600	N/A	N/A	149
76	45	73	19	700	N/A	N/A	159

## MAKE SYSTEM OPERATIONAL CHECK

Allow system to stabilize for 30 minutes after startup. If system is in pull down with extreme conditions it may not stabilize for several hours.

Measure, then record the following temperature and pressure readings in Table 4 on lines A thru T. Use system drawing below as reference for temperature/pressure reading points.

Determine possible system problem by comparing actual readings with typical readings found in Table 4. Apply them in the Quick System Analysis chart found on page 4 to further identify possible system problem.

### SUPERHEAT

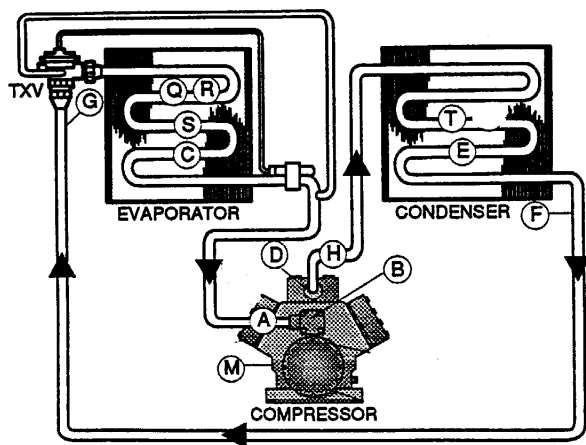
(A) (B) (C)

Compute the superheat by determining saturated suction temperature from Temperature-Pressure Chart on Page 2, and subtracting from actual suction line temperature.

### SUBCOOLING

(D) (E) (G)

Compute subcooling by subtracting liquid temperature entering TXV from saturated condensing temperature determined from Temperature-Pressure Chart on Page 2. Subcooling is listed on unit rating plate.



### (H) COMPRESSOR TEMPERATURES

Measure temperature of hot gas discharge line near service valve. Temperatures exceeding 300° F cause oil and refrigerant to break down.

(M) Record crankcase temperature. It should not exceed 125° F.

Refer to compressor operating temperature guidelines in Table 3 to determine possible problems.

### COMPRESSION RATIO

(P) Calculate the compression ratio by dividing absolute discharge pressure by absolute suction pressure.

$$\text{Example: } 260 \text{ psig} + 14.7 = \underline{274.7}$$

$$70 \text{ psig} + 14.7 = \underline{84.7} = 3.24 \text{ to } 1$$

### CAPACITY (See Table 3)

(Q) (R) (T)

Measure DB and WB temperatures entering and leaving evaporator and DB temperatures entering and leaving condenser. Record values in Table 3.

Use psychrometric chart to determine evaporator  $\Delta H$  (Btu/lb).

For condensing unit capacity look up the condenser CFM in the presale literature. Subtract the heat of compression of 25-30% for reciprocating and 20-25% for scroll compressors.

$$\text{Ex: } \text{BTUH} = 1.10 \times \text{CFM} \times \Delta T \times .75$$

Use formulas in Table 3 to calculate approximate evaporator and condenser capacities. Compare them to rated values. NOTE: Refer to GTA-3A "Air Properties & Measurement" for more information.

(S) (T) - Capacity Quick Check

Calculate temperature drop across evaporator and rise across condenser. Compare them to typical DB readings in Table 4.

**PROCEED TO QUICK SYSTEM ANALYSIS CHART, PAGE 4, TO FURTHER IDENTIFY SYSTEM PROBLEM.**

**RECORD SYSTEM PROBLEM:**

---



---



---

**TABLE 4 - Typical Operating Pressures and Temperatures  
(CAUTION: Check Manufacturer Recommendations)**

MEASUREMENTS (OUTDOOR AIR TEMPERATURE 85-95°F)			R-22	R-134A	R-410A	Actual System Readings
(A)	Suction Line Temperature	°F	51 - 53	51 - 53	62 - 66	
(B)	Suction Pressure	psig	68 - 72	37 - 41	136 - 142	
(C)	Sat Suction Temperature (Superheat: Line A-C)	°F (°F)	41 (10-12)	41 - 46 (10-12)	48 - 51 (10-14)	
(D)	Discharge Pressure	psig	260	168	380	
(E)	Sat Cond Temperature	°F	120	118	113	
(F)	Liquid Temp Leaving Condenser	°F	112	103	104	
(G)	Liquid Temp Entering TXV (Subcooling: Line E-G)	°F (°F)	110 See rating plate	101 See rating plate	102 See rating plate	
(H)	Hot Gas Discharge Line Temp	°F	180 - 200	134 - 150	161 - 165	
(M)	Crankcase Temp	°F	90 - 135	100 - 125	100 - 108	
(P)	Compression Ratio		2:1 to 4:1	3:1 to 4:1	2:1 to 3:1	
(Q)	Air Entering Evaporator	WB°F / DB°F	61 to 66 / 72 to 80	61 to 66 / 72 to 80	61 to 66 / 72 to 80	
(R)	Air Leaving Evaporator	DB°F	54 to 60	54 to 60	54 to 60	
(S)	Air Temp Drop Across Evaporator	DB°F	16 to 20	16 to 20	16 to 20	
(T)	Outdoor Air Temp	Hi Effic	15 to 20	15 to 20	15 to 20	
	Rise Across Condenser (DB) STD		20 to 30	20 to 30	20 to 30	

**QUICK SYSTEM ANALYSIS (□)**

SYSTEM PROBLEM	OPERATING TRENDS (LOW-NORMAL-HIGH)														
	SUCTION PRESSURE			DISCHARGE PRESSURE			SUPERHEAT			SUBCOOLING			AMPERES		
	L	N	H	L	N	H	L	N	H	L	N	H	L	N	H
Overcharge			•			•	•					•			•
Condenser (Air) Restricted			•			•	•			•					•
Non-Condensibles in System			•			•	•			•					•
High Evaporator Load			•			•		•			•				•
Loose TXV Feeler Bulb - Oversized TXV - Leaking TXV Seat - Wrong Equalizer Connection - Uninsulated Feeler Bulb			•			•	•			•					•
Undercharge	•			•					•	•					•
Liquid Line Restriction	•			•					•			•	•		
Low Outdoor Ambient	•			•					•			•	•		
Suction Line Restriction	•			•					•			•	•		
Evaporator Air (Cooler Liquid) Restricted	•			•			•					•	•		
Undersized TXV - Leaking Feeler Bulb - No External Equalizer	•			•					•			•	•		
Inefficient Compressor			•	•					•			•	•		
ACTUAL SYSTEM OPERATION (□)															

**INSTRUCTIONS:** Compare actual system operating condition (Step 6) with Typical Readings in Table 4. Record actual system readings in Analysis Chart above by inserting a 3 under Low-Normal-High columns. Read upward and left to determine possible system problem.