

Critical Charging - Fixed Metering

SAFETY

Working with refrigerants and electricity can be dangerous. High pressure refrigerants, gasses, and dangerous voltages pose a real threat to health, life, and property. Follow all manufacturer, OSHA, and local safety precautions. Be sure to wear eye and skin protection.

Charging Systems With Capillary Tube or Piston Metering Devices

Generally, units using a capillary tube or piston metering device require the technician to check the charge by measuring the superheat of the suction gas at the compressor, however, follow manufacturer's directions if available.

Remember

Superheat = Suction Line Temp. at the condensing unit—Saturated Evaporating Temp.

Saturated evaporating temp. is suction pressure in psig converted to temperature for the refrigerant used.

Suction line temp. is the actual temp. of the suction line entering the compressor (entering the condensing unit is the location if a split system). Fully insulate the temperature probe.

Checking Charge Using Superheat

Proper flow is required across the evaporator and condenser.

Run unit for 10-15 minutes before attempting to measure or alter a refrigerant charge.

Use manufacturer's charging

procedure if known. If not known, the following will be helpful.

- Be certain that a capillary tube or piston is the metering device used on the evaporator. and not a TXV. If the evaporator uses a TXV you should use the subcooling charging method discussed in our May newsletter, if manufacturer's instructions are not available.
- Determine the required superheat based upon the load on your evaporator and condenser using the chart on page 4.

Condensers only have 1 load—sensible. This can be determined by measuring the dry bulb (**db**) temperature of the air entering the condenser.

Evaporators have 2 loads imposed on them—sensible and latent. The total load on the evaporator is determined by taking the wet bulb (**wb**) temperature of the air entering the evaporator.

EXAMPLE

You are servicing a unit which contains R-22. Your suction pressure is 70 psig which converts to a saturation temperature of 41°F for R-22. Temperature of the suction line entering the condensing unit is 50 degrees F.

Air flows through the condensing unit and evaporator are found to be accurate.

$$SH = SLT - SET$$

Where:

SH is superheat

SLT is suction line temperature

SET saturated evaporating temperature

Recall: SET is suction pressure converted to saturated temperature using the appropriate temperature/pressure chart. Suction pressure of **70 psig** is found to have a saturated evaporating temperature (SET) of **41°F**.

$$\begin{aligned} \text{Superheat in our example} &= 50^{\circ}\text{F} - 41^{\circ}\text{F} \\ &= 9^{\circ}\text{F} \end{aligned}$$

The loads are found to be:

Condenser—90°F db

Evaporator—64°F wb

To determine the proper superheat for our conditions, find the intersection point for 90°F db, top of the chart, and 64°F wb, left side of the chart. We see that these two loads intersect at 9 degrees which is our correct superheat for the loads imposed on our evaporator and condenser.

Since the measured (**actual**) superheat, 9 degrees, is equal to the superheat found on the chart (**required**) our unit is properly charged.

If actual superheat had been higher than the chart indicated you should have for your conditions, the unit would have been undercharged. Refrigerant would need to be added to obtain the required superheat.

If actual superheat had been lower than the chart indicated you should have for the conditions, the unit would have been overcharged. The overcharge must be recovered in order to obtain the required superheat. *Tolerance is $\pm 5^{\circ}\text{F}$.*

Drawing on page 3 provides a visual look of where measurements are taken..

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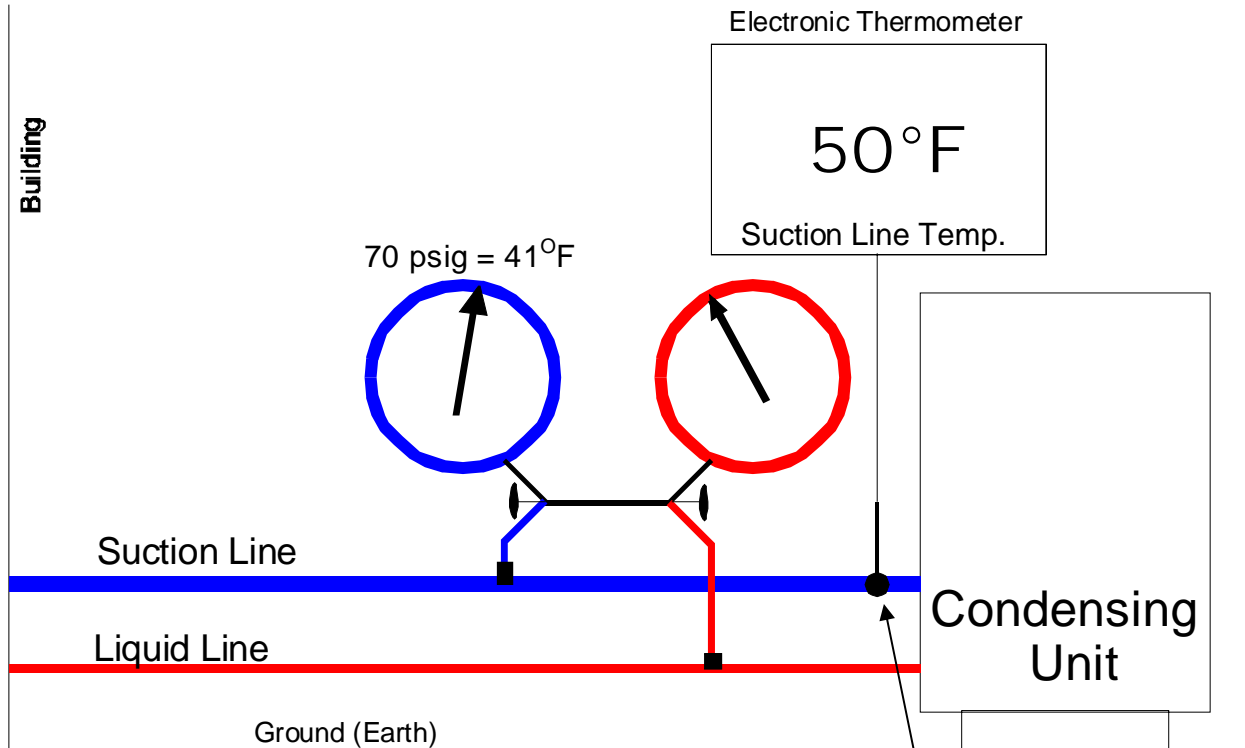
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Measuring Superheat

(Fixed Restrictor Systems Only)
TXV's Are Charged Using Subcooling



$$\text{Superheat} = 50 - 41$$
$$= 9 \text{ degrees (actual)}$$

Remember to insulate your suction line temperature probe from ambient air.

Calculation Of Required Superheat

R22 Fixed Orifice Metering Devices Only

Evap. Entering Wet (wb) Bulb Air Temp.	Condenser Air Entering Dry Bulb (db) Temperature												
	55	60	65	70	75	80	85	90	95	100	105	110	115
	Required Superheat Values Shown Below												
50	9	7	--	--	--	--	--	--	--	--	--	--	--
51	11	8	--	--	--	--	--	--	--	--	--	--	--
52	12	10	6	--	--	--	--	--	--	--	--	--	--
53	13	11	8	--	--	--	--	--	--	--	--	--	--
54	14	12	10	7	--	--	--	--	--	--	--	--	--
55	15	13	12	8	--	--	--	--	--	--	--	--	--
56	17	15	13	10	6	--	--	--	--	--	--	--	--
57	19	17	15	12	7	--	--	--	--	--	--	--	--
58	20	18	16	13	9	5	--	--	--	--	--	--	--
59	21	19	17	14	10	6	--	--	--	--	--	--	--
60	23	21	19	16	12	8	--	--	--	--	--	--	--
61	25	23	20	17	13	10	--	--	--	--	--	--	--
62	26	24	21	19	15	12	8	5	--	--	--	--	--
63	27	25	23	20	16	13	9	7	--	--	--	--	--
64	29	27	24	21	18	15	11	9	6	--	--	--	--
65	30	29	25	23	19	16	13	11	8	--	--	--	--
66	32	30	27	24	21	18	15	13	10	8	5	--	--
67	34	32	28	25	22	19	17	14	12	10	7	--	--
68	35	33	30	27	24	21	19	16	14	12	9	6	--
69	36	34	31	28	26	23	20	18	16	13	11	8	--
70	37	35	33	30	28	25	22	20	18	15	13	11	8
71	39	36	34	31	30	26	24	22	20	18	15	13	11
72	40	38	36	33	31	28	26	24	22	20	17	15	14
73	41	39	37	35	33	29	28	25	23	21	19	17	16
74	42	40	38	36	34	31	30	27	25	23	22	20	18
75	43	42	39	37	36	34	32	28	27	25	24	23	20
76	45	43	41	39	37	35	33	31	29	27	26	25	23

Important: to prevent the return of liquid refrigerant to the compressor and possible damage, DO NOT attempt to alter the charge in a system when the correct superheat is indicated by double dashes:

This chart should be used only when the condenser and evaporator air flows are adequate, room temperature close to set point, and no air or moisture exists within the system.

WHEN CHARGE ADJUSTMENTS ARE REQUIRED:

- 1) If ACTUAL superheat is HIGHER than shown above, ADD CHARGE to lower it.
- 2) If ACTUAL superheat is LOWER than shown above, RECOVER CHARGE to increase it.

Tolerance is + or - 5 degrees F

When available, use manufacturer's instructions, instead of the above table.

Remember: these systems should have superheat calculated at the condensing unit in the suction line

Temp	Psig	Temp	Psig	Temp	Psig
25	48.8	35	61.5	45	76.0
26	49.9	36	62.8	46	77.6
27	51.2	37	64.2	47	79.2
28	52.4	38	65.6	48	80.8
29	53.6	39	67.1	49	82.4
30	54.9	40	68.5	50	84.0
31	56.2	41	70.0		
32	57.5	42	71.5		
33	58.8	43	73.0		
34	60.1	44	74.5		