FLŌ ENERGY SOLUTIONS	Technical Guide	CO-GEN-01
Title:	How To Set Sub-Cooling And Superheat	

Field Instruction

It is important to note that the condenser, evaporator and filters must be clean and the dampers must be in working order before measuring sub-cooling or superheat to ensure proper air flow and accurate readings.

Verify Sensing Bulb Location

Ensure sensing bulb is tight and mounted at either just below the 3 or 9 o'clock position on the pipe.

If the sensing bulb is not positioned just below 3 or 9, remove the insulation, adjust the sensing bulb to just below 3 or 9, tighten the bulb to the pipe and reapply the insulation.

If the sensing bulb is not insulated but in the correct position, insulate the sensing bulb before proceeding.

Sub-Cooling and Superheat Conditions

We recommend that sub-cooling and superheat are verified at the beginning of each cooling season. Adjust only if necessary. Perform the verification under full load, or as close to full load condition as possible.

The unit is under a 'full load' when the discharge pressure (converted using the PT chart in Table 1) is equal to the ambient temperature plus 15°F - 30°F.

The following criteria must be met to perform sub-cooling and superheat verification:

1. Unit is under a 'full load'.
2. Ambient temperature must be above 80°F.
3. Return temperature must be above 70°F.
4. All compressors must be running at full speed.
5. Unit has been running for at least 15 minutes with criteria 1-4 met.

If all criteria above are met, begin verification of sub-cooling and superheat while the unit is in Comfort Cooling mode of operation.

Checking Liquid Sub-Cooling

1. Measure the temperature of the liquid line as it leaves the condenser coil.
2. Read the gauge pressure at the liquid line close to the point where the temperature was taken. You must use liquid line pressure as it will vary from discharge pressure due to condenser coil pressure drop.
3. Convert the pressure obtained to a saturated temperature using the appropriate refrigerant temperature-pressure chart (Table 1).
4. Subtract the measured liquid line temperature from the saturated temperature to determine the liquid sub-cooling.

Checking Evaporator Superheat

1. Measure the temperature of the suction line close to the compressor.
2. Read gauge pressure at the suction line close to the compressor.
3. Convert the pressure obtained to a saturated temperature using the appropriate refrigerant temperature-pressure chart (Table 1).
4. Subtract the saturated temperature from the measured suction line temperature to determine the evaporator superheat.

R410A	Temperature		R410A	Temperature		R410A	Temperature	
Pressure	F°	C°	Pressure	F°	C°	Pressure	F°	C°
78	20	-6.7	170	60	16.6	317	100	37.8
87	25	-3.9	185	65	18.3	340	105	40.6
97	30	-1.1	201	70	21.1	365	110	43.3
107	35	1.7	217	75	23.9	391	115	46.1
118	40	4.4	235	80	26.7	418	120	48.9
130	45	7.2	254	85	29.4	446	125	51.7
142	50	10	274	90	32.2	476	130	54.4
155	55	12.8	295	95	35	507	135	57.2

Table 1. Pressure Temperature (PT) Chart

Determining If Sub-Cooling And Superheat Adjustments Are Required

Compare calculated sub-cooling to Table 2 for the appropriate coil and system type to determine if adjustments may be required.

Sub-Cooling	Min Range	Max Range
Air-Cooled	8°F	15°F
Water Source Heat Pump	4°F	8°F

Table 2. Sub-Cooling Ranges

Compare calculated superheat to Table 3 for the appropriate coil and system type to determine if adjustments may be required.

Superheat	Min Range	Max Range
Air-Cooled	8°F	15°F
Water Source Heat Pump	8°F	15°F

Table 3. Superheat Ranges

NOTE: A recheck of subcooling and superheat are required following any refrigerant and/or TXV adjustments. Allow the unit to run for 15 minutes minimum before checking sub-cooling and superheat readings again following adjustments.

Adjusting An Overcharged System

The system is overcharged if the sub-cooling temperature is too high, and the evaporator is fully loaded (low loads on the evaporator result in increased sub-cooling) and the evaporator superheat is within the temperature range as shown in the table 3 (high superheat results in increased sub-cooling).

Correct an overcharged system by reducing the amount of refrigerant in the system to lower the sub-cooling.

Adjusting An Undercharged System

The system is undercharged if the superheat is too high, and the sub-cooling is too low.

Correct an undercharged system by adding refrigerant to the system to reduce superheat and raise sub-cooling.

When TXV Adjustments May Be Required

If the sub-cooling is correct and the superheat is too high, the expansion valve may need adjustment to correct the superheat.

NOTE: Each turn of the thermal expansion valve (TXV) changes superheat approximately 2°F. Adjust the thermal expansion valve (TXV) counterclockwise to decrease superheat and clockwise to increase superheat.

Post Adjustment Verification

Repeat verification and adjustment steps as required until readings are within the sub-cooling and superheat ranges stated in table 2 and table 3.

If you are unable to balance the system using this method, contact Flō Technical Support at 888-598-1198 Opt. 1 or at techsupport@systemsflo.com.

Sub-Cooling				***Refrigerant Adjustment***				***Superheat***				***TXV Adjusted***		
Circuit	**Initial Reading**	**Final Reading**		**Circuit**	**Added**	**Removed**	**Amount**	**Circuit**	**Initial Reading**	**Final Reading**		**Circuit**	**Yes**	**No**
A			**°F**	A	☐	☐		A			**°F**	A	☐	☐
B				B	☐	☐		B				B	☐	☐
C				C	☐	☐		C				C	☐	☐
D				D	☐	☐		D				D	☐	☐

Table 4. Superheat & Subcooling Readings & Adjustments