TECHNICAL SERVICE BULLETIN

LINE SET Recommendations

The following is a general planning and installation guideline for split-system piping or "Line Sets". The information is relevant whether using pre-made line sets or fabricating piping in the field. The specific system instructions should also be followed carefully to prevent early compressor failure and to protect your manufacturer warranties. Check your area for additional information such as local building codes, special regulations, and/or variances that are not provided by USCS, or manufacturer specifications.

Line sets consist of two semi-flexible copper pipes to connect the outdoor condensing unit to the indoor evaporator coil. The smaller pipe is called the liquid line (LL). The larger pipe is referred to as the suction line (SL), and includes insulation.

When designing the configuration of line sets, it is important to keep in mind the actual length as well as the functional length. Remember to include 90's, sharp bends, risers or up stream angles in line set length calculation. Each of these create additional restrictions on the fluid being moved in the lines. These restrictions function as if they are longer than a straight line would be. Improper fluid return could lead to early age compressor failure due to the insufficient oil return back to the compressor. USCS refrigeration systems are designed to pump refrigerant up to 50'. Longer runs can sometimes be achieved by precise measurements of all angles in the run, the introduction of exact amounts of additional oil to the system. Suction line accumulators are recommended on all systems. Due to the lower pressures that refrigeration systems work with when compared to Air Conditioning Systems extended line installation is strongly discouraged. Even with careful planning there is no certainty the system will function within proper parameters.

- Take adequate precautions to ensure the system is clean, free of particles and contaminates, and dry.
- Line sets should never obstruct or limit service access to the installed system components.
- Lines should be installed with as few bends as possible. Extra care should be taken with bends and couplings to avoid damage or kinks.
- To minimize noise transferred from the equipment to the structure, refrigerant lines should be insulated, isolated, and supported.
- Support should be at minimum intervals using appropriate tape, hangars and brackets. *Never solder vapor and liquid lines together. Individually insulated lines can be taped together for convenience, appearance, and support.

- To facilitate proper oil return a horizontal slope approximately 1 inch every 20 feet toward the condensing unit is best.

- A conduit of PVC piping should be used for all underground installations. Buried lines should be kept as short as possible.

- Where lines penetrate walls, additional insulation and a sealing material should be used.

- Insulate all vapor lines with a minimum 1/2" of foam rubber. Any liquid lines that will be exposed to high ambient temperature, weather, or direct sunlight should also be insulated. *All lines can be insulated for a more aesthetic appearance.

- To avoid contamination and prevent scaling during brazing, flow an inert gas such as Nitrogen through the system. **Do not use soft solder.** Braize all copper to copper joints with *Silfos-5* or an equivalent material. For additional advice on non-copper joints see: **TSB Joining Dissimilar Metals**

- If elbows are required, use long radius angles wherever possible.
  *See Table 1 for details

Table 1: EQUIVALENT LENGTHS OF ELBOWS IN FEET

LINE SIZE INCHES (O.D.	90° SHORT RADIUS ELBOW (FT.)*	90° LONG RADIUS ELBOW (FT.)
1/4"	0.7	0.6
5/16"	0.8	0.7
3/8"	0.9	0.8
1/2"	1.2	1
5/8"	1.5	1.3
3/4"	1.6	1.4
7/8"	1.8	1.6

* Two 45° radius ells equals one 90° radius ell

Though USCS provides suggested system line sizes for each assembly, suction and liquid line sizes can be altered to minimize pressure changes and improve oil return to the compressor where elevation differences exist between the indoor and outdoor sections.

When sizing refrigerant lines for split-system cooling units, the following factors must be considered:
- Suction line pressure loss due to friction.
- Suction line velocity for oil return.
- Liquid line pressure loss due to friction.
- Liquid line pressure loss (or gain) due to static head.
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The effect that each of these factors have on a cooling system depends on the orientation of the indoor and outdoor sections; e.g., indoor unit above the outdoor unit. Even the most well planned piping procedures can inadvertently create oil traps, and oil logging where elevation changes occur.