

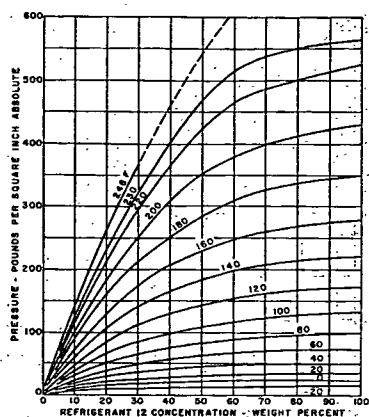


Fig. 9.... Solubility of Refrigerant 12 in a 240 SUV Paraffin Base Oil of German Origin¹⁰

Four general rules may be stated for partially miscible refrigerant-oil mixtures:

1. In the miscible range of compositions, the four rules stated earlier for completely miscible mixtures may be applied.
2. Under equilibrium conditions in the immiscible range, there are only two possible solution compositions at each given temperature, and the mixture will proportion itself accordingly.

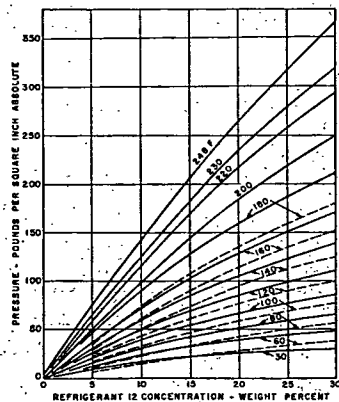


Fig. 10.... Solubility of Refrigerant 12 in Refrigeration Oils
Solid lines: 150 SUV and 300 SUV Naphthene base oils, also 240 SUV German Paraffin Base¹⁰
Broken lines: 150 SUV and 325 SUV Mixed Base Oils.¹¹

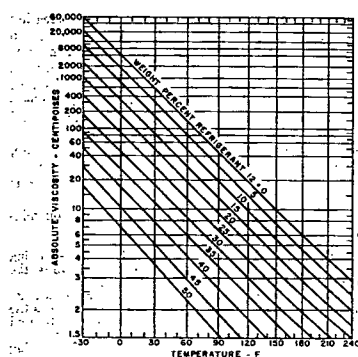


Fig. 11.... Viscosity-Temperature Chart for Solutions of Refrigerant 12 in 150 SUV Naphthene Base Oil¹²

3. The vapor pressure over the immiscible range is constant at a given temperature, no matter what proportion of refrigerant is mixed with the oil within that range.
4. The immiscible range is usually narrowed by increasing the temperature; and if no, a critical solution temperature will usually be found.

Totally immiscible refrigerants and oils, or both, are defined for the purpose of this chapter as being completely immiscible or, at most, only very slightly miscible. In such mixtures, the immiscible range is so broad that mutual solubility effects may be ignored in practice. Critical solution temperatures are seldom found in mixtures of the totally immiscible type. Examples are ammonia and oil, and carbon dioxide and oil.

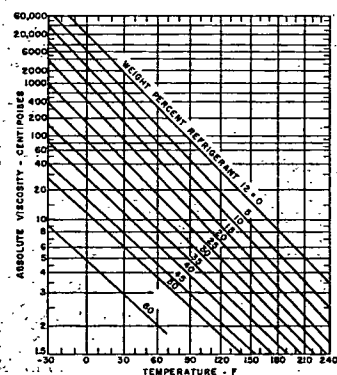
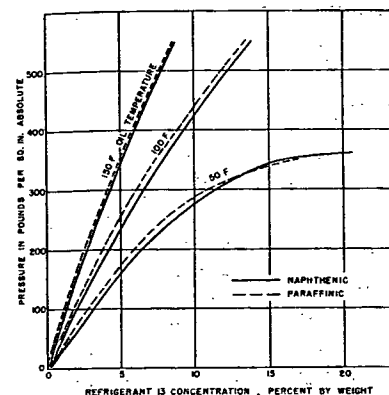


Fig. 12.... Viscosity-Temperature Chart for Solutions of Refrigerant 12 in 300 SUV Naphthene Base Oil¹²



Redrawn from Reference 13.

Fig. 13.... Solubility of Refrigerant 13 in 150 SUV Oils

Solubility Curves and Miscibility Diagrams

Published reports usually have not shown mutual solubility relations of partially miscible refrigerant-oil mixtures all on one diagram as is shown on graph (b) of Fig. 5. The model curves in this graph are pictured as extending over the whole range of refrigerant-oil concentrations, whereas in determining actual data, it has been a more common practice to conduct separate investigations of the miscible and immiscible ranges, i.e., the region lying to the left of the broken line (OC), are ordinarily plotted as pressure-temperature-solubility curves just as was done for completely miscible refrigerant-oil mixtures. Such curves must terminate for partially miscible mixtures when they meet the broken line (OC), since any attempt to further increase the refrigerant concentration then merely causes a second liquid phase, richer in refrigerant, to drop out of solution. Terminating points of this type can be seen in the Refrigerant 22 solubility curves attributed to H. J. Löffler (see Fig. 23); however it must be kept in mind that the position of the broken line marking the presumed beginning of the immiscible region will be different for different oils.

The immiscible range for a given temperature may be broad or narrow, according to the nature of the refrigerant and the nature of the oil. On the oil-rich side, however, even those refrigerants which exhibit broad immiscible ranges may dissolve significantly in the oil. Thus, Refrigerant 13, is classed as a low miscibility refrigerant (see Table 5 and Reference 8) but dissolves in mineral oil to the extent of about 20 weight percent at 50°F and 360 psia (see Fig. 13).

The immiscible range itself is generally plotted in the form of a temperature-miscibility curve, or, as it is sometimes called, a critical solubility curve. As a matter of convenience, the scale on the vertical axis of the miscibility curve is temperature rather than refrigerant pressure, as was the case in graph (b) of Fig. 5. Otherwise the miscibility curve is simply the dome (OCR), since the refrigerant pressure is fixed and determined by the mixture temperature at all equilibrium

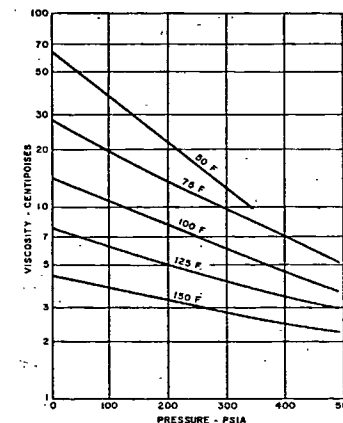


Fig. 14.... Viscosity of Mixtures of 80 SUV Naphthene Base Oil and Refrigerant 13¹³

points within the immiscible range (Rule 3). Likewise for convenience, the composition scale on the horizontal axis is often reversed from that shown in graph (b), and proceeds from left to right as the oil concentration is increased. The top of the dome may be read directly as the critical solution

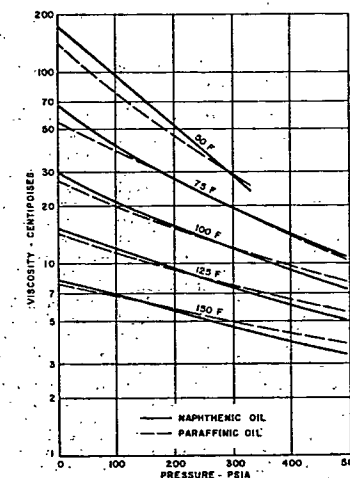


Fig. 15.... Viscosity of Mixtures of 150 SUV Oils and Refrigerant 13¹³