Chapter III

Threshold Problems

A pinch does not necessarily occur in all heat exchanger network problems. Certain problems remain free of a pinch until the minimum allowed driving force, δTmin, is increased up to or beyond a threshold value, $\delta T_{threshold}$. It is for this reason that we call these problems "Threshold Problems".

The concept of a threshold problem can be illustrated through Figure 3.1(a) to (c). In Figure 3.1(a) a pair of composite curves are shown relative to each other on the T/H diagram such that both hot and cold utilities are required. If the value of δTmin is reduced by shifting the curves together, there come a point where one of the utilities disappears as shown in Figure 3.1(b). In this example the cooling disappears. The value of δTmin at which this occures is termed "$\delta T_{threshold}$". If the curves are shifted further together, this does not cause a further change in utility requirements. It means that part of the hot utility can be supplied at the low-temperature end of the problem, as shown in Figure 3.1(c). Contrast this with the behavior of the "pinched" type of problem shown in Figure 3.1 (a). Here, both utilities are present and are always a function of δTmin.

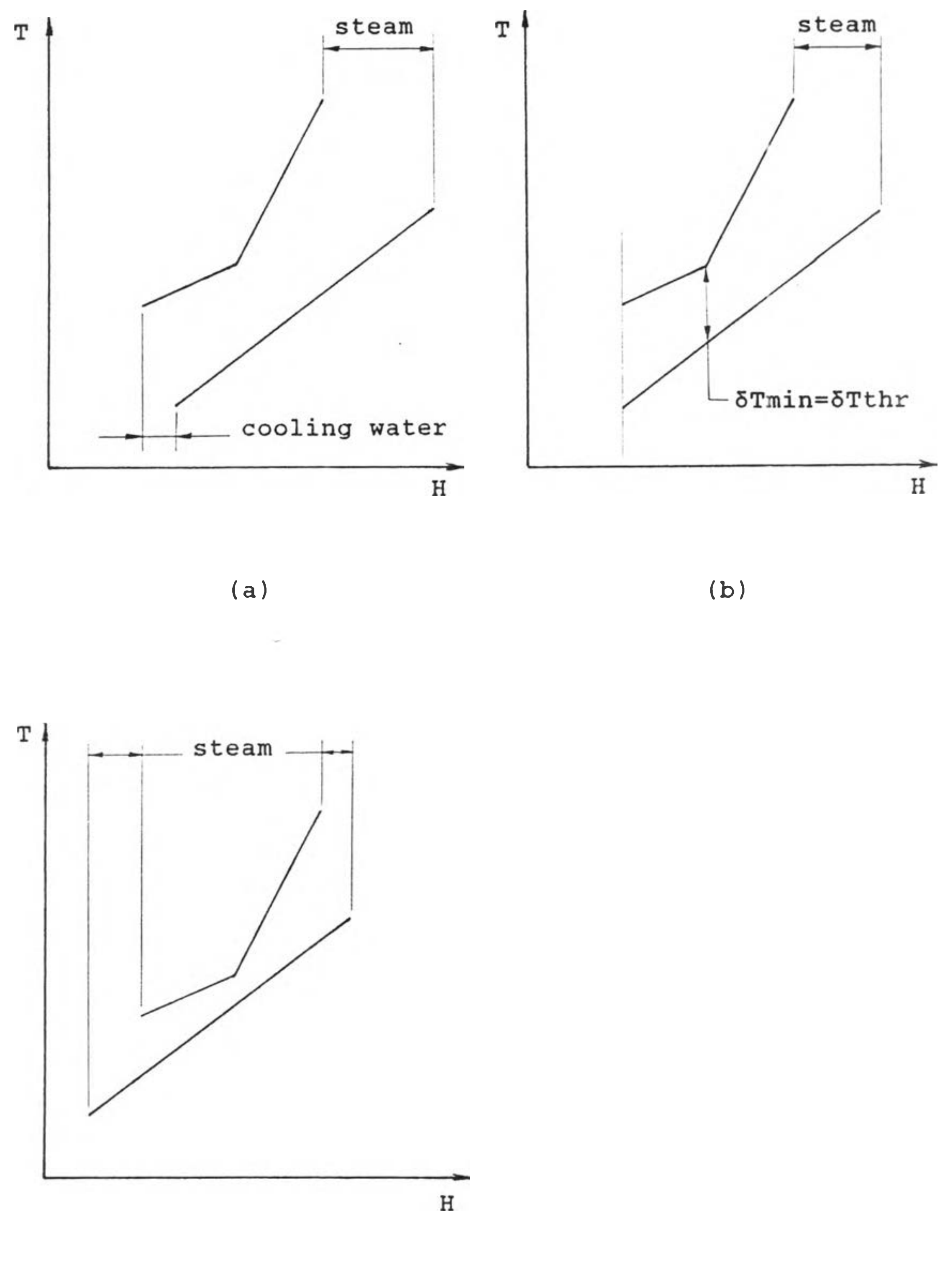

Figure 3.1 Threshold problem

The design of threshold problems is usually free of thermodynamic constraints of the pinch. This means that a great deal of design topology are possible. However, in the thesis a pseudo-pinch temperature will be evaluated, and the problem is to be considered as a pinch type problem. Therefore, the pinch design rules and heuristic rules for away-from-pinch design are applicable. The pseudo-pinch temperature is selected from either the highest or lowest interval temperature according to whether the location of $\delta T_{threshold}$ is closer to which end.