CHAPTER 11
HEAT EXCHANGERS

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11.1 INTRODUCTION

Most geothermal fluids, because of their elevated temperature, contain a variety of dissolved chemicals. These chemicals are frequently corrosive toward standard materials of construction. As a result, it is advisable in most cases to isolate the geothermal fluid from the process to which heat is being transferred.

The task of heat transfer from the geothermal fluid to a closed process loop is most often handled by a plate heat exchanger. The two most common types used in geothermal applications are: bolted and brazed.

For smaller systems, in geothermal resource areas of a specific character, downhole heat exchangers (DHEs) provide a unique means of heat extraction. These devices eliminate the requirement for physical removal of fluid from the well. For this reason, DHE-based systems avoid entirely the environmental and practical problems associated with fluid disposal.

Shell and tube heat exchangers play only a minor role in low-temperature, direct-use systems. These units have been in common use in industrial applications for many years and, as a result, are well understood. For these reasons, shell and tube heat exchangers will not be covered in this chapter.

11.2 GASKETED PLATE HEAT EXCHANGERS

The plate heat exchanger is the most widely used configuration in geothermal systems of recent design. A number of characteristics particularly attractive to geothermal applications are responsible for this. Among these are:

1. Superior thermal performance.

   Plate heat exchangers are capable of nominal approach temperatures of 10°F compared to a nominal 20°F for shell and tube units. In addition, overall heat transfer coefficients (U) for plate type exchangers are three to four times those of shell and tube units.

2. Availability of a wide variety of corrosion resistant alloys.

   Since the heat transfer area is constructed of thin plates, stainless steel or other high alloy construction is significantly less costly than for a shell and tube exchanger of similar material.

3. Ease of maintenance.

   The construction of the heat exchanger is such that, upon disassembly, all heat transfer areas are available for inspection and cleaning. Disassembly consists only of loosening a small number of tie bolts.

4. Expandability and multiplex capability.

   The nature of the plate heat exchanger construction permits expansion of the unit should heat transfer requirements increase after installation. In addition, two or more heat exchangers can be housed in a single frame, thus reducing space requirements and capital costs.

5. Compact design.

   The superior thermal performance of the plate heat exchanger and the space efficient design of the plate arrangement results in a very compact piece of equipment. Space requirements for the plate heat exchanger generally run 10% to 50% that of a shell and tube unit for equivalent duty. In addition, tube cleaning and replacing clearances are eliminated.

Figure 11.1 presents an introduction to the terminology of the plate heat exchanger. Plate heat exchanger, as it is used in this section, refers to the gasketed plate and frame variety of heat exchanger. Other types of plate heat exchangers are available; though among these, only the brazed plate heat exchanger has found application in geothermal systems.

As shown in Figure 11.1, the plate heat exchanger is basically a series of individual plates pressed between two heavy end covers. The entire assembly is held together by the tie bolts. Individual plates are hung from the top carrying bar and are guided by the bottom carrying bar. For single-pass circuiting, hot and cold side fluid connections are usually located on the fixed end cover. Multi-pass circuiting results in fluid connections on both fixed and moveable end covers.