CHAPTER 10
PIPING

Kevin D. Rafferty, P.E.
Geo-Heat Center
Klamath Falls, Oregon 97601

10.1 INTRODUCTION

The source of geothermal fluid for a direct use application is often located some distance away from the user. This requires a transmission pipeline to transport the geothermal fluid. Even in the absence of transmission line requirements, it is frequently advisable to employ other than standard piping materials for in-building or aboveground piping. Geothermal fluid for direct use applications is usually transported in the liquid phase and has some of the same design considerations as water distribution systems. Several factors including pipe material, dissolved chemical components, size, installation method, head loss and pumping requirements, temperature, insulation, pipe expansion and service taps should be considered before final specification.

In several installations, long transmission pipelines appear to be economically feasible. Geothermal fluids are being transported up to 38 miles in Iceland (Karlsson, 1982). In the U.S., distances greater than 5 miles, are generally considered uneconomical; however, the distance is dependent on the size of the heat load and the load factor.

Piping materials for geothermal heating systems have been of numerous types with great variation in cost and durability. Some of the materials which can be used in geothermal applications include: asbestos cement (AC), ductile iron (DI), slip-joint steel (STL-S), welded steel (STL-W), gasketed polyvinyl chloride (PVC-G), solvent welded PVC (PVC-S), chlorinated polyvinyl chloride (CPVC), polyethylene (PE), cross-linked polyethylene (PEX), mechanical joint fiberglass reinforced plastic (FRP-M), FRP epoxy adhesive joint-military (FRP-EM), FRP epoxy adhesive joint (FRP-E), FRP gasketed joint (FRP-S), and threaded joint FRP (FRP-T). The temperature and chemical quality of the geothermal fluids, in addition to cost, usually determines the type of pipeline material used. Figures 10.1 and 10.2 introduce the temperature limitations and relative costs of the materials covered in this chapter. Generally, the various pipe materials are more expensive the higher the temperature rating. Figure 10.2 includes 15% overhead and profit (O&P).

Installation costs are very much a function of the type of joining method employed and the piping material. The light weight of most nonmetallic piping makes handling labor significantly less than that of steel and ductile iron in sizes greater than 3 in.

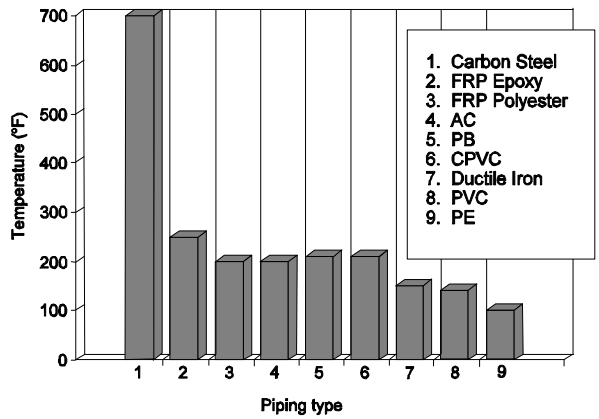

Figure 10.1 Maximum service temperature for pipe materials.

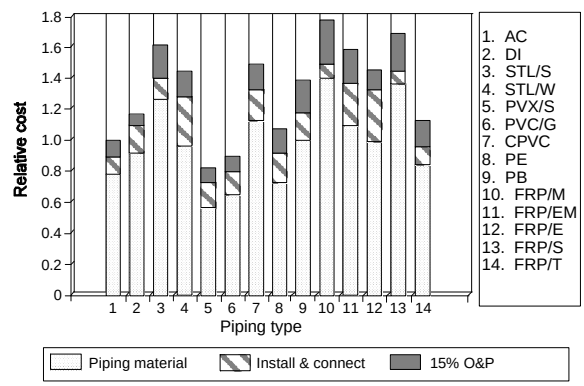

Figure 10.2 Relative cost of piping by type.

10.1.1 Piping Currently in Use

The following data was taken from a survey (Rafferty, 1989) of 13 operating geothermal district heating systems. The total main line (>2 in.) piping included in the systems reviewed for that report amounted to approximately 260,000 linear feet (lf).

Figure 10.5 provides a breakdown of the total piping by type in open systems, the most dominate design. As indicated, asbestos cement (AC) material is clearly the most widely applied product with approximately 55% of the total piping in these systems. Steel and fiberglass are a distant second to AC. Only minimum quantities of polybutylene, ductile iron and PVC are in use. Of note is the fact that