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## **SPECIFICATION for Juneau Airport Terminal Ground Source Heat Pump System**

### 1.1 DESCRIPTION

- A. System: The heating, ventilating, and air-conditioning system for the Airport Terminal will be a ground source heat pump system (GSHP). The system will consist of a closed-loop vertical well field, a ground loop pumping system that moves heat between the ground and the building, and water-source heat pumps that condition the spaces within the building and supply domestic hot water.
- B. Performance: The system will supply heat at a coefficient of performance (COP) of 2.6. For every kWh of purchased energy consumed by the heat pump compressors, 2.6 kWh of heat is supplied to the building. The well field has a high water table and steady water flow that makes it ideally suited for long-term heat extraction.

### 1.2 GEOTHERMAL GROUND COUPLING

- A. Description: The ground couple will consist of closed-loop vertical well field and field piping connecting the wells with the building.
- B. Wells: The well field will consist of 215 wells, each 6" in diameter and 175' deep. The wells will be cased during drilling and the casing removed during backfill operations. A ¾" HDPE pipe loop will be placed in each well and the well backfilled with native material. Each well loop will be pressure tested prior to backfilling. Direct ground water contact with the pipe loop will provide very good thermal conductivity between the ground source fluid and the ground.
  - 1. Test Well: A test well was drilled at the site in November, 2007 and the data gained will form the basis for competitively bidding the work. While a temporary water use permit was obtained from the Department of Natural Resources for the test well, the closed loop system will not require permits.
- C. Well Field Piping: Field piping will consist of three insulated HDPE pipe loops, each connected to an equal number of wells. Each branch will connect to a pair of wells in series. The piping will be laid in trenches and pressure tested prior to backfilling.
- D. Site Excavation and Restoration: The well field and field piping will be installed beneath the Commuter / Air Taxi Parking Area. The existing pavement will be removed prior to excavating pipe trenches and drilling wells. All piping will be a minimum of 18" below the surface. Sub-base and new paving will be installed upon completion of the field piping.

### 1.3 GROUND SOURCE PUMPING SYSTEM

- A. Description: Ground source pumps will circulate water between the well field and the heat pumps located within the building.
- B. Building Piping: The field piping loops will be manifolded together within the building and connected to the building distribution piping. Piping within the building will be insulated HDPE piping. The piping will be filled with an antifreeze solution to prevent freezing.
- C. Loop Pumps: Three variable speed loop pumps will be used to provide redundancy and so the pump capacity more closely matches the flow requirements at partial loads. Each pump will be variable speed with the flow rate controlled by a differential pressure sensor in the building loop.

### 1.4 HEAT PUMPS

- A. Description: The building will be primarily heated with water-to-air heat pumps. Water-to-water heat pumps will be used for radiant in-floor heating and for domestic hot water heating.
- B. Water-to-air Heat Pumps: The building will have 61 thermal zones, each served by a water-to-air heat pump. Each heat pump contains a fan that circulates and conditions room air as needed. When heat or cooling is required, the heat pump compressor unit exchanges heat with the ground source piping and transfers it with the room air stream. The heat pumps will be capable of both heat and cooling.
  - 1. A backup electric resistance heating coil will be installed in heat pumps located in critical spaces to ensure heat if the compressor requires maintenance.
  - 2. Heat pump compressors are typically on-off devices. In spaces where thermal comfort is more critical—offices, dining, etc.—variable speed compressor will be provided to minimize temperature fluctuations.
- C. Water-to-water Heat Pumps
  - 1. Domestic Hot Water: Two water-to-water heat pumps will produce domestic hot water for the facility. The heat pumps will maintain a hot water storage tank at 120°F.
  - 2. Radiant In-floor Heating System: A water-to-water heat pump will supply heating water for in-floor radiant heat in the baggage claim lobby and high-use exterior walkway.

### 1.5 VENTILATION

- A. A dedicated outdoor air system (DOAS) will supply code required outdoor air to each heat pump. The DOAS will be variable air volume with the supply to each room modulated to match actual occupancy. This system will significantly reduce ventilation air flow in the highly variable occupancy terminal. The DOAS will have a heat recovery cell to exchange heat from the building exhaust air to temper the outside air. The unit will also have a water-to-air heat pump to bring the air temperature up to building temperature.

1.6 EQUIPMENT SCHEDULE

A. The following table provides a schedule of the equipment required for the GSHP system.

<b>Equipment Schedule</b>	
<b>Equipment</b>	<b>Capacity</b>
Well field	215 wells spaced on 10' center Each well 175' deep and 6" diameter ¾" HDPE closed pipe loop in each well
Well field piping	Three loops of insulated HDPE piping
Ground source pumps (3)	225 gpm @ 150' head, 15 HP, variable speed
Water-to-air heat pumps (61) 30°F EWT, 3 gpm/ton	6 MBH (2); 12 MBH (26); 18 MBH (7); 24 MBH (2); 30 MBH (14); 36 MBH (5); 60 MBH (2) ; 72 MBH (1) ; 150 MBH (2)
Water-to-water heat pump (1)	120 MBH, 30°F EWT, 3 gpm/ton
Domestic hot water heat pump (2)	120 MBH, 30°F EWT, 3 gpm/ton
Hot water storage tank	300 gallons
Dedicated outdoor air system	Commercial terminal: 7,000 cfm water-to-air heat pump with heat recovery cell; variable air volume Commuter terminal: 3,000 cfm water-to-air heat pump with heat recovery cell; variable air volume