

Geothermal System for New Central York High School



The new 230,982ft² facility for New Central York High School is relying on a renewable energy geothermal heat pump system to provide low energy consumption space conditioning for many years into the future. Studies show that approximately 70% of the energy used in a geothermal heating and cooling system are renewable energy from the ground. The money saved by installing a Geoexchange heating and cooling system will provide additional funds to be utilized for education instead of running a conventional heating and cooling system.

PROJECT DETAILS

New Central High School Geothermal Heat Pump System

Contractor: Morrison Inc.

LOCATION

York, PA

PRODUCTS USED

GEOTHERMAL GROUT™

Mike Rash of Morrison, Inc. explained that in a typical eastern Pennsylvania winter the ground soaks up solar energy, so it's much easier to grab warmth from the ground at 52°F than from the open air when the temperature is below freezing. The geothermal system at New Central York High School will push warm air through the schools ventilation system, even when the outdoor air temperature is extremely cold. On the other hand, in summer the ground heats up slower, the somewhat cool ground accommodates the schools surplus heat from the four well fields more willingly than the balmy outdoor air.

INSTALLATION

Morrison, Inc. of Duncannon, Pennsylvania was responsible for drilling and installing the vertical boreholes, installing the casing and the double coil loops into the boreholes, grouting the boreholes with a 1.00 Btu/hr/ft/F GEOTHERMAL GROUT, and installing and connecting the piping. Each double coil loop is manufactured from high density polyethylene resin with u-bends fused to the ends. Mike Rash of Morrison, Inc. was responsible for the geothermal installation. Mike is an IGSHPA Accredited Installer and has been involved in the geothermal industry for the last 21 years.

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The subsurface installation of the loop field started with air rotary drilling 256 boreholes 5 5/8 inch in diameter to a depth of 600 feet. A total of 307,200 feet or over 58 miles of pipe was installed in the vertical boreholes. Four well fields were positioned around the school consisting of 64 boreholes of four rows of 16, spaced 15 feet on center. The 64 loops were fed into a central manifold at the end of the well field, then into the building ending in pipe flanges. Morrison has their air rotary drilling rigs designed for high production. Jace Bittle, the Superintendent for Morrison, Inc., said his rigs were designed to drill fast, typically more than 700 feet per day.

SOIL CONDITIONS

Only an average of 10 feet of saprolitic top soil was deposited on top of the Dolomite bedrock at this site. The top 5-10 foot layer of Dolomite was weathered and friable, after that it was hard and massive to the bottom at 600 feet. Water was encountered around an average of 35 feet.

GROUTING THE WELLS WITH GEOTHERMAL GROUT

After the loop is filled with water it was pressure tested and inspected for leaks and inserted into the borehole. The holes were then grouted from the bottom to the top.

To begin grouting, 22 gallons of freshwater was pumped from a nearby fire hydrant into a paddle-mixing tank of a commercial grout mixer equipped with an automatic sand feeder. The grout mixer was capable of mixing two batches of GEOTHERMAL GROUT at a time. For this project the normal single recipe was 22 gallons of freshwater + 50 lbs of GEOTHERMAL GROUT + 300 lbs of a 40/60 silica sand. This yielded 38 gallons of a 65.2% solids grout at 14 lb/gal with a thermal conductivity (TC) of 1.00 Btu/hr/ft/F. The grout was mixed for about three minutes, as the sand was added into the grout tub by the automatic sand feeder at a steady rate. The grout was mixed for another two minutes to obtain a consistent mixture, then pumped with a positive displacement pump through a 1 1/4" (I.D.) tremie pipe over 650 foot long at a rate of 5 to 15 gallons per minute.

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CETCO Drilling Products manufactures GEOTHERMAL GROUT, a specially blended high solids bentonite grout when added with sand forms a thermally conductive grouting material. GEOTHERMAL GROUT is mixed to meet a range of thermal conductivities depending on the specific conditions of the site geology. Depending on the soil type, these ranges can be from 0.40 to 1.00 Btu/hr/ft/F. GEOTHERMAL GROUT has been carefully developed as a thermally conductive grout to heighten the performance of closed-loop ground-source heat pump systems.

The efficiency and system performance of closed-loop ground-source heat pump systems is improved by matching, at a minimum, the thermal conductivity and permeability of the surrounding soil. Depending on site soil conditions, GEOTHERMAL GROUT can be mixed and adjusted to meet individual thermal conductivity requirements, improving the transfer of heat between the fluids circulated in the loop and the surrounding soil for optimum system performance.

Geothermal technology has the endorsement of the U.S. Department of Energy and the Environmental Protection Agency. Today the geothermal industry is busy mainly due to executive order 12902 mandating substantial increases in energy efficiency and conservation measures at federal facilities.

Geothermal heating and cooling systems generate no burning or smoke. This aids in decreasing greenhouse gases, carbon dioxide and sulfur dioxide emissions into the atmosphere. With never-ending increases in energy costs, the public likes the fact that geothermal systems drastically reduce our reliance on the earth's limited stock of fossil fuels.

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