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GEOTHERMAL HEAT PUMPS:
Project Specifications

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KEY WORDS

geothermal heat pump specifications, geothermal heat pump guidelines

PROJECT BACKGROUND AND STATUS

A critical need for A&Es, engineers, installers, procurement officers, and project managers is the need for pre-developed, generic specifications for GHPS systems, sub-systems, materials and products. Generic specification packages will decrease the time and effort required to complete each project, significantly decrease the design and procurement costs, increase consumer confidence, and will also increase consistency between projects. Quality design and construction require the communication of and agreement to following specific procedures and the use of specific equipment/material. Specifications are also a guide during inspection to verify compliance.

Specifications for GHP systems from several commercial applications, have been thoroughly reviewed including a Navy military housing facility, three schools, an integrated convenience store, the IGSHPA Architect-Engineering Training Manual, The Waterfurnace Training Manual, and two Army military facilities.

Specification-writing guides for heat pumps, trenching, backfilling, well drilling, piping systems, HVAC Pumps, packaged terminal air conditioning units, and liquid coolers were obtained from The Construction Specification Institute to be used for examples for writing specifications.

A matrix analysis format was designed which shows the numerous categories of specifications related to GHP projects and key words used in each category so that specifications from each source can be compared to each other. This matrix included grouting, plastic pipe, heat pumps, circulators/pumps and controls. This revealed numerous instances of wide variations in the areas covered and the contents of the areas. It also revealed wide variations in the use of the specification numbering system.

Minimal information relating to vertical loop grouting was apparent, based on the matrix analysis. As a result, specifications were written and assembled based mostly on the materials found in the IGSHPA Grouting Manual. Also, specifications were written and assembled on GHP piping systems from information found in IGSHPA publications since many of the source specifications were not up to date, not appropriate, or had not covered piping.

Using the matrix analysis showing various segments of specifications for the heat pump equipment and components, revealed alternative specifications from several sources can be selected and one most appropriate can be used or modified if needed.

Preliminary analysis of the circulating pump system specifications and system controls specifications have begun.

PROJECT OBJECTIVES

Project objectives are to produce specifications which will provide direction in quality design, construction, inspection and future operations. These specifications are to be sufficiently versatile to apply to various climate regions, and be applied to private or government organizations with minimal modifications.

Technical Objectives

- To provide sufficient explanation or sources of information that designers can be assisted in design concepts for their projects and clients can have clarity in complying to the specifications.

- To provide a source of direction which will assist in the reduction of operational difficulties and inappropriate designs.

Expected Outcomes

An expected benefit of these specifications is to assist agencies such as DoD, HUD, GSA and the private sector in GHP procurement.

A salient feature of the results of this task is the savings in time and retention of accuracy in concluding a project by having specifications available for the GHP project. Developing these project specifications are time consuming and require attention to detail. With a basic set of specifications available there will only be small changes required to satisfy the job requirements.

APPROACH

Sample generic project specification materials for five GHP system components, namely: grouting, plastic pipe, heat pumps, circulators/pumps and controls will be developed. Information will be assimilated from manufacturers, engineering firms, suppliers, contractors regulatory and technical organizations. This material is also intended to be integrated into DoD and HUD specifications. In order to meet the special military requirements contacts will be made with appropriate DoD individuals and organizations. This information will be compiled into a three part format: general, products and execution. Within the general part the items covered will normally be divided into sections entitled related documents, description of work, quality assurance and submittals. Products and materials will be described in the products part of the specifications. Basic information found in the execution part of the specifications will include inspection, installation and reports.

RESEARCH RESULTS

Research has shown that *some* ground source projects are not operating properly because certain design and construction features are not being adhered to by the responsible entities. Most often it appears to be from inexperience or lack of knowledge. It is the purpose of this project to incorporate information which will lead to design and construction procedures which will be checks and balances toward achieving satisfactory results.

An outline of some of the guiding concepts are listed in the following four topics, these are to augument the five detailed specifications:

1.0 The heat pump system must be selected to satisfy the heating and cooling requirements of a particular zone (load). The heat pump system may include auxiliary heating during winter loads and a cooling tower during summer cooling loads.

2.0 The heat pump should/must be ARI rated:

2.1. for heat pumps operating with anentering liquid temperature range from 60 to 85 F, a unit rated under ARI Condition 320 must be used

2.2. for heat pumps operating with an entering liquid temperature range from 45 to 85 F, a unit rated under ARI Condition 325 must be used

2.3. for heat pumps operating with an entering liquid temperature range from 25 to 115 F, a unit rated under ARI Condition 330 must be used.

3.0 The heat pump selected must be compatible with the working fluid (corrosion inhibited water or antifreeze.) The working fluid must:

3.1. have acceptable fluid properties such as low viscosity

3.2. have good heat transfer characteristics

3.3. be non-corrosive to the heat exchanger

3.4. have acceptable flammability properties

3.5. be free of harmful particulate contaminants

3.6. not contain chemicals that will precipitate out or reduce the effectiveness of added corrosion inhibitors.

4.0 Ground heat exchanger field drawings. A drawing which details pipe size (diameter wall thickness, material, placement and length) for the headers and loops for the as-built condition is to be delivered to the owner upon completion of the project.

FUTURE PLANS

All of the five specifications are to be completed and made available through IGSHPA.

INDUSTRY INTEREST AND TECHNOLOGY TRANSFER

Interest by industry will grow once they become aware of the new specifications and guidelines which indicate improved methods. Features of the specifications will be made known through The Source (IGSHPA Newsletter) and taught in the Geothermal Heat Pump System Design Training for Architects and Engineers.