利用建筑基础作地源热泵系统

Use of construction base for ground-source heat pump system

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现在的大部分建筑均以重型构造为主，需要重型基础作为支撑体系并占据一定的地面面积，现在的技术装备水平已经完全可以充分利用建筑物基础以下的地下温度场，作为储存冷热量的块体，利用地下温度传导比较慢和岩石或土壤热容量大的特点，将其变成一个冷（热）量储存体，通过工程设计的技术手段，将塑料换热管均布在建筑基础的周围并用砼浇筑加以保护，达到作成地下换热器的目的。由于换热管是设置在基础垫层的外围、不会影响基础垫层的受力机理，也就不会影响结构的受力体系，因而是安全的设计方案。

Now most of the buildings are constructed of heavy-based, require heavy base as support system and occupy a certain surface area, the current level of technology and equipment can make full use of the building has been the basis of the following underground temperature field, as the cold storage heat block body, the use of underground temperature is relatively slow conduction and rock or soil thermal characteristics of large capacity, turning it into a cold (hot) the amount of storage, by engineering design techniques, the plastic heat exchange tube uniformly distributed around the base in the construction and use of concrete pouring to be protected, to achieve the purpose of作成underground heat exchanger. As the heat exchange tube is set in the basic cushion the periphery, will not affect the basic force of cushion mechanism also does not affect the structure of the force system, and therefore it is safe design.

地下换热器是利用建筑基础桩中埋设的换热盘园管作单元换热体，用水平干管将若干个单元换热体的盘园管连接成一个系统，用循环水作为温度差的载体，与热泵主机进行热交换，从而达到使用低品位能源的目的。

Ground heat exchanger is the use of building foundation pile in the garden planted heat exchanger plate heat exchanger tube for cell body, with the level of trunk mains will be a number of units of the plate heat exchanger body into a pipe connected park system, use recycled water as the temperature difference between vector, and host heat pump heat exchange, so as to achieve the purpose of the use of low-grade energy.

低品位能源几乎无处不在；空气，水体，土壤和岩石都具有一定的温度，只要和使用温度形成一定的差值、并且可以利用的能源形式，就是低品位能源。

我国大部地区的冻土层（没有冻土层的地区，在 1 米左右。）以下的温度场是一个低品位能源储蓄体，采用何种技术方案将其合理利用是应关注的问题，但有一点可以肯定，目前的地下水和 U 型管式的水源热泵系统已经初步成熟，但更经济和合理的建筑基础桩基埋管系统开始进入人们关注的视线，怎样将其推广和普及是建筑设备节能工作的重心。

Low-grade energy is almost everywhere; air, water, soil and rock have a certain temperature, so long as a certain temperature difference, and can be used, that is, low-grade forms of energy.

Permafrost in most areas of China (no frozen soil area, at 1 meter.) The following is a low-grade

temperature field of energy savings and body, in what would be reasonable to use technical solutions should be of concern, but the To be sure, the current groundwater and U-tube type of water source heat pump system has an initial maturity, but more economical and rational basis for the construction of pile foundation system, begun to enter the pipe line of sight of people's attention, how the promotion and popularization of its construction equipment energy conservation center of gravity.

空气的热容和导热系数与水体，土壤或岩石相比相差几个数量级，因此空气源热泵在效率和经济上远不如地源热泵优秀和可靠。地源热泵系统的地下换热器（与桩基结合制作）一旦完成，其使用寿命可长达上百年，也就是说“上部建筑重建，也可以使用已有的地下换热器”。（即便在地震后上部结构垮塌重建，地下的桩基只要内部管道不断裂仍然可以继续使用。）

Air heat capacity and thermal conductivity coefficient of water, soil or rock compared to a difference of several orders of magnitude, so air-source heat pump efficiency and economy far less ground-source heat pumps good and reliable. Ground-source heat pump system, an underground heat exchanger (with the pile with production), once completed, the service life of up to a hundred years, which means "reconstruction of the upper part of the construction, you can also use the existing underground heat exchanger." (Even in the upper part of the structure collapsed after the earthquake reconstruction, underground pipes within the pile as long as no fault can still continue to use.)

地源热泵的好处就是可以最大程度地减少化石能源的消耗。在没有使用热泵机组以前、通常：夏季为了使室内温度适宜人体需要，使用制冷机将室内多余的热量（太阳辐射负荷，灯光、电器负荷及人体散热量）搬运出室内，散放在大气中，简称为“制冷排热过程”；冬季为了维持适宜居住和工作的室内温度，通过燃烧化石燃料和少部分可再生的植物燃料以获取热量维持室温，简称为“燃烧取热过程”，但这些热量还是最终还是散放在大气中，最终和其他因数构成了“气候变暖”的作用推手。采用地埋管式热泵系统可以将夏季的得热储存于地下土壤或岩石中，冬季通过热泵系统将这部分热量取出来使用，这样就可以达到少消耗或者不消耗化石燃料的目的。

The benefits of ground source heat pump is the ability to minimize fossil energy consumption. In the absence of the use of heat pump units before, usually: the indoor temperature in summer in order to fit the human body needs, use the cooler indoor excess heat (solar radiation load, lighting, electrical load and the amount of body heat) carrying out the interior, scattered on the atmosphere, referred to as "the process of refrigeration heat"; winter, suitable for living and working in order to maintain the indoor temperature, through the burning of fossil fuels and a small number of renewable fuels produced from plants to get the heat to maintain room temperature, referred to as "burning for heat process", but these heat Or finally, scattered on the atmosphere, the ultimate and other factors constitute the "climate change" the role of promoter. Pipe-type heat pump system used in the summer heat gain can be stored in underground soil or rock in this part of the winter through the heat pump system to take the heat out of the use, so that we can achieve little or no consumption of fossil fuel consumption purposes.

至于各地区由于地理和气候原因造成存储于地下的冷热量不平衡问题，则可以通过技术手段加以解决，存储热量多、取得少的地区，（我国南方夏热冬暖地区）可以用热泵机制取卫生热水方式供应热水，以减少地下温度场的温度升高，这同样可以减少卫生热水消耗化石燃料的用量；存储热量少、取热量得多的地区，（我国北方夏热冬冷和寒冷地区）则可以通过太阳能热水系统的热量加以补充，以维

持地貌的原始温度，采用建筑基础桩埋管的地源热泵系统，可以通过设计将冬夏季供热和供冷问题及卫生热水使用综合考虑，形成完整的能源合理利用循环。

As for the various areas due to geographical and climatic causes of the cold heat stored in the underground imbalance, it can be resolved through technical means, storing the heat more in areas with little access to, (Hot Summer and Warm Winter Zone in southern China) can be obtained with the heat pump system means the supply of sanitary hot water hot water to reduce the temperature of underground temperature field, which can also reduce health hot water consumption of fossil fuels consumption; store less heat, take the heat much more areas, (hot in summer and cold winter in northern China and the cold regions) through the solar water heating systems can be supplemented by the heat to maintain the topography of the original temperature, the use of building foundation pile pipe ground source heat pump system, you can design winter and summer heating and cooling problems and sanitary hot water the use of comprehensive consideration to form a complete cycle of the rational use of energy.

地埋管式地源热泵和太阳能热水器及太阳能光伏发电组合可以成为零能耗的节能组合，同理、地埋管式地源热泵和太阳能热水器及风力发电组合也可以组合成零能耗的供热制冷体系。地埋管式地源热泵系统是将目前不要的冷热量存储于地下，并根据需要随时将想要用的冷（或者热）量，取出来使用。

To pipe-type ground-source heat pump and solar water heaters and solar photovoltaic electricity generation, energy saving can be a combination of zero-energy, empathy, to pipe-type ground-source heat pump and solar water heaters and wind electricity generation, can also be combined into a zero-energy of heating and cooling system. In pipe-type ground-source heat pump system is not currently call for the cold heat stored in the ground, and you want to use as needed to keep the cold (or hot) the amount taken out of use.

应该大力推广建筑桩基础埋塑料换热管的形式（挖孔桩和独立柱基均可），这样做的目的是最大限度的降低工程造价、节省初投资、且做好的换热器有水泥的保护具有更好的使用寿命和换热性能，且施工质量可控、施工工法可以规范化、也就是说这种地下换热器的整体质量可以通过施工管理得以保证。

Should vigorously promote the construction of pile foundation in the form of buried plastic heat exchange tube (dug pile and the independent column base can be), the purpose of doing so is to maximize the reduction of project cost, saving the initial investment, and the heat exchanger are doing a good job of cement protection of life and better heat transfer performance, and the construction quality control, construction and engineering methods can be standardized, meaning that the overall quality of underground heat exchanger can be assured through the construction management.

水平埋管方式在利用场平回填土时也有很好的经济性。在山地较多的地区应该注重水平埋管的地源热泵系统，建设初期的场平工程如能将埋管问题一起做完是最省工和省造价的，也就是说地源热泵最经济的形式“就是和建筑基础施工或者在场地平整时一起完成”，在此时所耗费的投资最小，系统经济性最好。初步估算增加 40-60 元/㎡，就可以把地下换热器做好。

Horizontal way back to fill in the use of field level when there is a good economy. In the more mountainous areas should focus on Horizontal ground source heat pump system, construction projects such as the initial field-level problem with the pipe can finish the quickest and most cost workers and provinces, that is the most economical ground source heat pump form "is the foundation and building construction or site preparation in conjunction with its completed" in the time-consuming investment minimum, the system the economy the best. Preliminary estimates to increase 40-60 yuan / ㎡, you can do the underground heat

exchanger.

我国在地质条件较差的地区多采用独立柱基的基础形式，独立柱基一般有较大的垫层受力面，周边垂直面是设置换热管的好地方。只要设计得当，施工加以质量进程控制，这种地下换热器是工程质量可控、可检、可调整，因而施工质量容易达到设计要求，其换热性能在设计阶段就可以通过设计计算确定，以保证达到使用的目的。

In the geological conditions of China's poor areas to use more independent form the basis of column-based, independent plinth generally have a greater surface cushion force, peripheral vertical is a good place to set the Tube. As long as properly designed, should be the quality of the construction process control, this underground heat exchanger is the project quality control, can seize, adjustable, and thus the quality of construction likely to meet the design requirements, the heat transfer performance at the design stage can be determined by design calculations, in order to guarantee the achievement of the purpose of use.

挖孔桩也是我国较多地区采用的的建筑结构基础形式之一，具有局部下沉式施工的特点，可根据地质条件变化随时调整基础施工深度，简单易操作，在劳动力较便宜的地方被大量采用。

利用挖孔桩做地源热泵系统也有较好的经济性和可操作性。在设计时将结构所需直径做调整，直径放大 100mm 用作敷设塑料换热管道即可满足要求，系统的热量平衡和所需埋管的数量有一定的数量关系，因而在桩孔数一定时，其桩基深度要求和埋管数量要做一些平衡调整。

Drilled piles are also used in China's large area of the building structure forms the basis of one of sink-style construction with local characteristics, geological conditions can change at any time to adjust the depth of foundation construction, simple and easy to operate, cheaper places in the labor force has been a large number of used.

The use of dug pile to do ground-source heat pump system has a good economy and maneuverability. Structure in the design will be adjusted to fit the required diameter and a diameter of 100mm zoom can be used for the laying of plastic Tube Road meet the requirements, the system's heat balance and the required number of pipe have a certain amount, and so, when a certain number of holes in the pile , the number of pile depth requirements and the pipe doing some balance adjustment.

在地质构造为冲积成型的地区，建筑基础桩多采用摩擦桩的形式，而摩擦桩一般都在工厂加工成型，这对作基础换热桩是有利条件，只要制造工序、技术措施正确也可做成很好的地源热泵换热桩。

Forming in the geological structure of the alluvial areas, building foundation pile in the form of multi-use of friction piles, while the friction piles are generally processed in the factory molding, which is a foundation piles are favorable conditions for heat transfer, as long as the manufacturing process, technical measures have to do the right into a good ground source heat pump heat exchanger pile.

从理论上讲，只要结构基础桩的设计深度满足换热需求的深度，完全利用结构基础桩是可能的，但实际设计中，基础桩施工由于地质原因、往往需要做一些调整，使得地下换热量的数量不满足设计要求，因此就需要一些单纯换热的换热桩体作为补充。换热桩和挖孔桩的形式大致一样，只是其设计直径要大一些，中间没有结构钢筋笼，一般换热桩的直径控制在 1.5m-2m 之间，深度根据储热总量的要求确定。

In theory, as long as the structural basis for the design of pile depth to meet the needs of the depth of heat exchangers, take full advantage of the structure foundation pile is possible, but the actual design, the foundation pile construction of geological reasons, often need to do some adjustments to make underground heat transfer The number does not meet the design requirements, and therefore need some

simple heat transfer in heat exchanger pile as a supplement. Heat exchanger piles and piles in the form of digging holes is largely the same, but its design should be larger in diameter, in the middle no structural reinforcement cage, the general control of heat transfer pile diameter between 1.5m-2m, depth, according to the requirements of thermal storage to determine the total .

现在每年有大量的建筑需求，因而新建建筑数量每年都在增长，这同样会带来以后使用能源的要求，这就是我们面临能源刚性增长需求的问题。我们应该学会加快合理的使用能源方法，为减少资源消耗，保护地球的生态环境，为发展合理的经济循环体系，改变建设观念，更新设计方法，加快建筑结构基础埋管的建设工作。

Every year a large number of construction needs, and therefore the number of new buildings is growing every year, which will bring the same energy requirements of the future, that is, we are faced with rigid growing energy demands. We should learn to speed up the rational use of energy methods, in order to reduce resource consumption, protect the Earth's ecological environment for the development of rational economic cycle system, to change the construction of concepts, updating the design ways to speed up structural basis for the construction of pipe work.