municipal water supply and drainage pipeline design technical measures

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Abstract: The design technology of municipal water supply and drainage pipeline is a very important part in the construction of urban infrastructure. With the acceleration of the urbanization process and the growth of population, the demand for water supply and drainage system becomes more urgent and complex. Therefore, designers must deeply analyze the key points and principles of municipal water supply and drainage pipeline design, and work out scientific and reasonable technical measures to ensure the safe and efficient operation of the pipeline system and meet the growing domestic and industrial water needs of urban residents. This paper will deeply discuss the key points, design principles and specific technical measures of municipal water supply and drainage pipeline design, to provide reliable reference and guidance for urban pipeline design.

Key words: Municipal water supply and drainage pipeline; Design technology; measures

I. Analysis of the key points and principles of municipal water supply and drainage pipeline design

In the construction of urban infrastructure, the design of water supply and drainage pipeline undoubtedly occupies a pivotal position. It is not only related to the daily life needs of urban residents, but also directly affects the environmental quality, economic development and social stability of the city. Therefore, as water supply and drainage pipeline designers, we must deeply understand and master the design of the key points and principles, to ensure that each project can achieve both practical and beautiful, both economic and environmental protection effect.

The focus of municipal water supply and drainage pipeline design, first of all lies in the deep understanding of urban planning. This includes the prediction of the future development of the city, the grasp of the urban spatial layout, and the understanding of the various functional areas of the city. Designers need to have a clear idea of which areas have high population density, which areas have high industrial activity and which areas have strict environmental protection requirements. These factors will directly affect the design scale, direction, material and laying method of the pipeline. Secondly, the focus of the design is to follow the technical specifications. The design and construction of water supply and drainage pipelines must conform to the relevant national and local standards and norms, which is the basis for ensuring the safe and effective operation of pipelines. Designers need to be familiar with and master these technical specifications to ensure that each design can meet the requirements.

The principles of municipal water supply and drainage pipeline design are mainly reflected in the following aspects. The first is the safety principle. Whether it is water supply pipeline or drainage pipeline, it must ensure that it can still operate normally in extreme weather, geological disasters and other emergencies, and there will be no safety accidents such as leakage or damage. Secondly, the principle of economy. Designers need to meet the safety requirements of the premise, as far as possible to reduce the cost of design and construction, improve the economic benefits of the project. This includes choosing reasonable pipes, optimizing design schemes, reducing unnecessary waste and so on. Thirdly, the principle of environmental protection. With the improvement of people's awareness of environmental protection, the design of water supply and drainage pipelines also needs to fully consider environmental factors. For example, in the design of drainage pipes, we need to consider how to effectively treat sewage and reduce the impact on the environment. Finally, there is the principle of aesthetics. Although water and drainage pipes are mostly underground, their presence can still have an impact on the landscape of a city. Designers need to consider how to coordinate the pipes with the surrounding environment and enhance the beauty of the city while meeting the functional needs.

II. Technical measures for design of municipal water supply and drainage pipelines

1. Rigid interface

Municipal water supply and drainage pipeline system is an important part of urban infrastructure, and its design quality and operation efficiency are directly related to the daily operation of the city and the quality of life of residents. As the key link of the pipeline connection, the choice and implementation of the design technical measures of the rigid interface is particularly important.

Rigid interface, as the name suggests, refers to the pipe connection, through rigid materials or structures, so that the formation of a fixed, non-deformable connection between the pipes. This interface form is widely used in municipal water supply and drainage pipes, especially in the case of high pressure and strict sealing requirements, the rigid interface can effectively prevent the leakage and damage caused by external force or foundation settlement of the pipeline. In the design of rigid interface, the first consideration is the sealing of the interface. This requires the interface material not only to have good compressive performance, but also to have good elasticity and corrosion resistance. Commonly used rigid interface materials include cast iron, reinforced concrete, etc. These materials can not only withstand the pressure changes inside and outside the pipeline, but also resist the erosion of corrosive substances in the soil. In addition to material selection, the structural design of the interface is also the key to rigid interface technology. A common rigid interface structure is the "T"

interface, which makes the pipe connection more tight and not easy to leak through the design of prominent flanges and grooves. At the same time, the bolt connection of the interface also needs to be carefully designed, not only to ensure the fastness of the connection, but also to consider the convenience of installation and disassembly.

In practical application, the design of rigid interface also needs to be combined with specific engineering conditions. For example, in areas with complex geological conditions and large foundation settlement, the design of the rigid interface needs to be specially strengthened to prevent the damage of the pipeline interface caused by the foundation settlement. In addition, for earthquake-prone areas, the design of rigid interfaces also needs to consider the impact of seismic forces to ensure that the pipeline system can remain stable when an earthquake occurs and avoid leakage accidents caused by the damage of the interface. The design and technical measures of the rigid interface also need to pay attention to the coordination with other links. For example, in the pipeline laying process, the sealing treatment of the interface should be combined with the anti-corrosion treatment of the pipeline to ensure the overall performance of the pipeline. At the same time, the installation and maintenance of the rigid interface is also a part of the design that cannot be ignored. When installing, ensure the accurate alignment of the interface to avoid the leakage of the interface caused by improper installation; During maintenance, the tightness and integrity of the interface should be checked regularly to discover and deal with potential problems in time.

2. Inner packing

In the design of municipal water supply and drainage pipelines, the inner packing as a key technical measure, its importance can not be ignored. It not only affects the service life of the pipeline, but also directly relates to the operating efficiency of the whole water supply and drainage system. Therefore, the research on the selection, application and related technical measures of the inner packing has far-reaching practical significance and academic value.

The inner packing usually refers to the material filled in the area where the inner wall of the pipeline is in direct contact with the water flow. The selection and design of these materials are directly related to the anti-corrosion, anti-scale and wear-resistant properties of the inner wall of the pipeline. In the water supply and drainage pipeline, because the water flow may contain various impurities, corrosive substances and microorganisms, under the long-term action, it will cause corrosion and scaling problems on the inner wall of the pipeline, thus affecting the normal use of the pipeline. Therefore, the selection and application of the inner packing is particularly important. When choosing the inside packing, the first thing to consider is its corrosion resistance. Commonly used inner packing materials include ceramics, rubber, plastic and so on. These materials have good corrosion resistance and can maintain good stability under long-term water erosion and chemical erosion. At the same time, they also have good wear resistance, which can effectively resist the wear of impurities in the water flow to the inner wall of the pipeline.

In addition to corrosion resistance and wear resistance, the inner packing also needs to have good anti-scaling properties. In the water supply and drainage pipe, because the water flow may contain various minerals and impurities, under the action of a long time, it is easy to form a scale layer on the inner wall of the pipe, affecting the water flow speed and the service life of the pipe. Therefore, the selection of the inner filler needs to take into account its anti-scale performance. Some new types of inner packing materials, such as nanomaterials, super hydrophobic materials, etc., have good anti-scale performance, can effectively reduce the formation of scale layer, improve the service life of the pipeline. In addition, the application of the inner packing also needs to be combined with specific engineering conditions. At the same time, the installation and maintenance of the inner packing is also a part of the design that cannot be ignored. When installing, it is necessary to ensure that the packing is closely fitted with the inner wall of the pipeline to avoid gaps; When maintaining, it is necessary to regularly check the integrity and anti-scaling performance of the packing, and timely replace the damaged or degraded packing.

3. External packing

In the design of municipal water supply and drainage pipes, the selection and application of external packing is a crucial technical measure. It is not only directly related to the stability and service life of the pipeline, but also the key factor to ensure the smooth operation of urban water resources supply and drainage system. The selection of external fillers should take into account many factors such as soil properties, pipeline materials, groundwater level, climatic conditions and construction conditions.

The primary function of the outer packing is to provide sufficient support and protection to ensure that the pipeline will not be deformed or damaged due to external force during long-term use. This requires the packing to have a good load carrying capacity and compression modulus, and can form a stable support system around the pipeline. For example, in some areas with poor geological conditions, such as soft soil or sandy soil areas, you can choose to use hard fillers such as sand or gravel to improve the bearing capacity of the pipeline. These hard fillers not only have high strength and stability, but also can effectively prevent the settlement of the pipeline due to soil erosion. The outer packing also needs to have good water permeability to ensure that the water around the pipeline can be discharged in time to prevent the pipeline corrosion and damage caused by the accumulation of water. The packing with good water permeability can effectively reduce the influence of the groundwater level on the pipeline and improve the anti-floating ability of the pipeline. In the actual project, the selection of the external packing needs to be combined with the specific construction conditions and design requirements for comprehensive consideration. At the same time, in the packing laying process also need to take the corresponding technical measures, such as compaction, vibration, etc., to ensure the compactness and uniformity of the packing.

4. Flexible interface

In the design of municipal water supply and drainage pipes, the flexible interface is used more and more widely as an important technical measure. Compared with the traditional rigid interface, the flexible interface has its unique advantages, such as good sealing, strong seismic ability and long service life, and has become the first choice in modern urban pipeline design. The design principle of the flexible

interface lies in the elasticity and deformability of the interface material. It can absorb and disperse the external force through the elastic deformation of the interface when the pipeline is subjected to external force, thus reducing the risk of pipeline damage. At the same time, the flexible interface can also effectively prevent the expansion of the pipeline caused by temperature changes, and maintain the stable operation of the pipeline.

In the municipal water supply and drainage pipeline, the application of flexible interface is mainly reflected in the following aspects: First, the flexible interface can effectively prevent the fracture of the pipeline caused by foundation settlement or earthquake. Due to the rapid development of urban construction, natural disasters such as foundation settlement and earthquake often occur, which poses a serious threat to the safe operation of pipelines. The flexible interface can absorb these external forces through its elastic deformation ability, thus reducing the risk of pipeline damage. Secondly, the flexible interface can also improve the connection tightness of the pipeline. The traditional rigid interface is prone to leakage due to poor connection, which not only wastes precious water resources, but also may pollute the surrounding environment. And the flexible interface through its excellent sealing performance, can effectively prevent the waste of water resources and environmental pollution. In addition, the flexible interface can also adapt to the thermal expansion and contraction of the pipeline. In the water supply and drainage pipeline, due to the change of water temperature, the pipeline will appear thermal expansion and cold contraction. If the rigid interface is used, it is easy to loosen or break the interface because of the expansion of the pipeline. The flexible interface can adapt to the expansion of the pipeline through its elastic deformation and maintain the tightness of the interface.

Conclusion: The research of technical measures for the design of municipal water supply and drainage pipeline is an important part of urban infrastructure construction, and also a key link to ensure the normal operation of the city and the quality of life of residents. Through the deep discussion and research of the key technologies such as rigid interface, inner filler, outer filler and flexible interface, we can better grasp the design principles to ensure the stability, durability and safety of the pipeline system. At the same time, we should also give full consideration to the long-term planning of urban development and the needs of environmental protection, pay attention to the coordination and unification of pipeline design and urban planning, and promote the sustainable development of urban infrastructure.

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