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# Safety Problems and Solutions of External Heating Network

Junfeng Qi<sup>1\*</sup>, Lingyue Zhang<sup>1</sup>, Huitong Zhao<sup>1</sup>

<sup>1</sup>Jilin Jianzhu University, Changchun, Jilin, 130000

\* 1612582865@qq.com

**Abstract.** With the continuous development of society and economy, people's material and cultural needs and quality of life continue to improve, the pace of urbanization is accelerating, and the safety of urban heating network is more and more worthy of our attention. Urban central heating is directly related to the comfort degree of residents' life and the harmonious development of society. Therefore, this paper focuses on the analysis of the security problems existing in the external network of central heating, and puts forward corresponding solutions.

## 1. Introduction

Heat source, heat network and heat user are three main components of central heating. Central heating pipe network is a pipeline system in which the heat source of central heating conveys and distributes heating medium to heat users. Its main function is heating from heating station to heat exchange station, and heating from heat exchange station to residential building. As the most critical part of the central heating system, due to the influence of various factors, there are many safety problems. In order to meet the policy of energy saving, environmental protection and sustainable development, the following aspects will be analyzed.

## 2. Security Problems in External Networks

### 2.1 *Quality of Heating Network Personnel and Construction Quality Problems*

China's urban scale is constantly expanding, and the population is increasing year by year, so the demand for urban heating is particularly important. When the design drawings are not closed, the pipelines will be crossed, the pipeline network will be damaged, the installation will be unbalanced and the final rework will be done. There are not a few safety problems in the construction, the supervision of the construction personnel is not omitted, and the safety is neglected in management.

The development of urban central heating is fast, but it will be limited by technology and capital. There is a gap between materials and standards. Pipeline materials have poor corrosion resistance, compression resistance and high temperature resistance. Housing heating will be hot and cold.

### 2.2 *Management of External Heating Network*

The state pays great attention to the development of urban infrastructure, but under the good development, there will still be omissions in the management of pipeline network and lack of certain norms.

#### 2.2.1 *Operation Management*

Operational management will cause pipeline blockage and equipment not working due to mixing waste and impurities generated during construction into the system under the action of water



circulation before water supply enters users after the construction of the external network, The pipeline will be blocked and the equipment will not work when the external network is running. As a manager, we should always clean the external network filter as a whole. When the network is re-watered, we must pay attention to the exhaust and drainage at the highest and lowest points of the network.

### *2.2.2 Daily Management*

If leakage occurs in a section of the pipeline, the corresponding managers will carry out maintenance and inspection. This sub-regional management method is too mechanized and lacks flexibility.

### *2.3 Influence of Laying Mode*

The laying methods of heating pipelines generally include direct burial, overhead, underground ditches and urban comprehensive pipelines. Among them, direct burial and urban comprehensive pipeline are the most common. Urban comprehensive pipelines need constructors to do a good job of investigating the construction site. Pipe trenches are interlaced with water pipelines, wires and so on. Even the phenomenon of digging and breaking occurs, which brings unnecessary trouble. In Northeast China and other places, the direct burial method is mainly used, while the direct burial method is also the most problematic. Due to the existence of groundwater and surface water, there are strict requirements on the quality of heat preservation pipe, the form of heat preservation structure and the tightness of material. If the buried pipe depth does not meet the specifications, the interface is not clean, there are some impurities, sewage infiltration, resulting in pipeline corrosion. The connection strength of pipeline is very low, which will cause distortion and cracking in the welding position, resulting in leakage problems.

### *2.4 Compensator Problem*

Compensator has square, waveform, sleeve, double pull rod and other types. For each type of its installation, there are certain requirements, such as: the center line of the pipeline and the center line of the sleeve have too large probability of different axes; the square compensator should be stretched for a certain length before installation. If this step is omitted or the position is not properly installed, the compensator will tilt and the life will be greatly reduced.

The problem of buried ripple compensator is the most serious. Compensator buried directly underground is a problem worth solving for every maintenance and repair, as well as whether the external environment of thermal insulation is dry. For some cities near the sea, because of the pollution of domestic sewage, the concentration of chloride ion in water will gradually increase. With the increase of chloride ion concentration, it penetrates into the compensator. Tensile stress will cause stress corrosion cracking under the action of internal pressure, which will bring great hidden dangers. If the expansion range of the bellows compensator exceeds a certain value, a pressure on the pipeline will be generated, which will force the pipeline to compress and deform, and then crack the joint of the steel pipe. The exterior of the buried corrugated compensator is wrapped by polyethylene outer casing, sealed by thermal shrinkage band, and then used polyurethane as insulation material. Over time, heat shrinkable bags may lose their use in soaking water. At the same time, the polyurethane insulation layer and polyethylene outer guard pipe will displace at the same time of the thermal displacement of the working pipe. As the working pipe elongates together, the compensator can not absorb the thermal displacement of the insulating pipe and the outer guard pipe, so the joint will crack.

### *2.5 Corrosion Problem*

The harmfulness of corrosion in heating process must not be neglected. One kind of corrosion occurs inside the pipeline. Heating media such as water, steam and pipe wall are directly contacted, resulting in electrochemical corrosion. The main reason is that the concentration of dissolved oxygen varies in the pipeline. Water and oxygen dissolve and react with the cathode. The higher the concentration of dissolved oxygen is, the more serious the corrosion is. Some soils with lower pH value are more

corrosive. Because the heat medium in heating system is usually hot water, if the temperature of hot water increases, the activation energy of reaction increases, with the increase of oxygen content and the speed of oxygen ion diffusion, the more easily it reacts with iron ions, the resistance value of electrolyte will decrease, and the probability of pipeline corrosion will increase. Moreover, when the heat medium is heated to boiling water, the pipeline corrosion will become more serious, all of which belong to the above. Partial corrosion.

The other is external corrosion. The directly buried metal pipeline is in long-term contact with the medium (gas, liquid, solid, etc.) in the soil, and the reaction results in pipeline corrosion. Soil is an inhomogeneous and corrosive electrolyte. There are many microorganisms in soil. Soil temperature is the key factor affecting corrosion. The higher the temperature, the faster the cathode diffusion rate, the more active the microorganisms in the soil, and the faster the corrosion of metal pipelines. As the salt content in soil increases, the corresponding chloride ion concentration increases, the resistivity decreases, the soil corrosiveness increases, and the more easily it reacts with metal pipelines, leading to pipeline leakage.

### **3.Measures to Improve the Safety of External Heating Network**

#### *3.1 Strengthen Quality Education and Controlling Construction Quality*

Safety education has always been the key content. For the construction personnel, we should establish safety consciousness. We can carry out safety assessment once a few months or a year. We can evaluate the operation norms, ideological education, hidden danger treatment and so on, select the grades and give rewards and punishments. The design should conform to CJJ34-2010 "Code for Design of Urban Heating Pipeline Network" and CJ28-2014 "Code for Construction and Acceptance of Urban Heating Pipeline Network Engineering".

In recent years, the pace of urbanization is accelerating. The quality of heating pipelines in cities is the key to the vital interests of tens of millions of users. The quality of pipes should be strictly controlled from two aspects: one is to control the quality of raw materials; the other is to select businesses with good reputation and strong production capacity for material suppliers. Secondly, the inspection of valves, compensators, welding rods, elbows and tee materials is the most important. Strict inspection of wall thickness, corrosiveness, compression resistance and waterproofing should comply with national regulations, and the corresponding product certificates and inspection certificates. Second, the construction quality is strictly controlled and measured according to the high standard of the design drawings. Increase and reduce elbow design in appropriate locations to meet the requirements of other urban design. In foundation pit excavation, soil conditions, pipeline excavation depth, backfill density and slope should be considered. After completing the position of valve well, center line and compensator in pipeline, continuous measurement and correction are carried out. In addition, backfilling should be stratified, stratified compaction, backfilling should be done manually away from the top of the pipeline.

#### *3.2 Strengthen the Management of External Heating Network*

##### *3.2.1 Strengthening Operation Management*

Many cities in our country have different problems during the operation of the pipeline network, which have a negative impact on the heating effect. One of the solutions is to achieve scientific regulation and effective design of the pipeline network. Only in this way can the heating system work steadily and safely. Attention should be paid to the regulation of the pipeline network, and the unbalanced phenomenon of the pipeline network should be adjusted one by one according to the different installation forms and operation conditions of each heating user. When the heat and cold are uneven in the house, the users can adjust the heating temperature by themselves by designing control equipment, so as not to affect other pipelines and avoid mutual influence.

### *3.2.2 Strengthen Daily Management*

The premise of safe operation of pipeline network is the daily management of external network. Enhancing the ability of inspection, maintenance and troubleshooting of external heating network can make the operation of pipeline network safer and more effective. Leak detection of pipeline network is the most important aspect for inspection team to carry out investigation. The inspection personnel can be further urged to realize the importance of inspection through the inspection responsibility system and assessment mechanism, equipped with accurate instruments, or through the establishment of the whole process information system of hidden danger investigation and treatment, to solve the existing problems.

### *3.3 Solutions to Laying Mode Problems*

Most domestic heating external networks are laid directly, because the direct burial is deep underground, so we need to use welding on the connection between the directly buried pipeline and pipeline accessories. The pipeline accessories should have enough compressive capacity to withstand the axial force of the pipeline. After the welding is completed, the strength sealing test is carried out, and the next work is carried out after meeting the welding standard. When the pipeline crosses the highway, steel plate should be added and underground concrete support frame should be added to protect the pipeline when crossing the railway. Polyurethane rigid foam is generally used for thermal insulation of buried pipelines. This material has good thermal insulation, little thermal conductivity, good insulation effect, light weight, waterproof and corrosion resistance, so many of them use this material. In addition, the pressure, strength and tightness of the valve should be tested, the stress of the tee and the valve should be reduced according to the design parameters of the pipe network, and the deformation of the elbow due to thermal expansion and cold contraction should be reduced. The selection of the installation position of the valve should be scientific and reasonable to ensure the safety and convenience of the valve.

### *3.4 Compensator Problem Solution Measures*

For the problem of the probability of different axes of compensator and pipeline, we can effectively solve this problem by referring to the standard design in construction and installing the compensator after pipe breaking. The pre-stretching of square compensator is to improve the compensating ability of compensator, so stretch a certain length before installation, and then compensate. This also reduces the thrust of the fixing bracket.

If the way of directly buried compensator is chosen in engineering, the construction site should be investigated and investigated firstly, the relatively dry soil condition and the lower groundwater position should be selected to ensure the construction quality, which reduces the problem of water immersion of compensator, reduces the probability of cracking at the interface and increases the service life. Life. For the river area, we should adopt the overhead way, through reasonable natural compensation, can also reduce the problem. In order to prevent pipe compression and deformation, we should control the expansion value of compensator within a reasonable range, set up limit device and movable sealing bellows, and add a centrifugal glass wool soft insulation material to the movable end of compensator, so that strict control, supervision and design are conducive to the polyethylene outer protective pipe and polyurethane. Absorption of thermal displacement of protective layer.

### *3.5 Anti-corrosion Measures*

For anti-corrosion problem, first of all, the internal corrosion of pipeline should be solved. The main cause of corrosion is the excessive concentration of dissolved oxygen, so it is very necessary to reduce the concentration of dissolved oxygen. At the same time, the hot water in pipeline should be tested according to the design standards, which is more conducive to solving the corrosion problem. We should control the pH within a reasonable range. The general pH value of circulating water is between 12 and 14, which can effectively reduce the corrosion rate. In addition, in the pipeline operation, we should strengthen the cleaning of the inner wall of the pipeline to prevent the residual impurities from

causing corrosion to the pipeline. Internal corrosion can also be prevented by internal coating and corrosion inhibitors.

In external anti-corrosion, the drier the soil conditions, the less salt content, the larger the soil resistivity and the weaker the corrosiveness. The soil conditions, water quality and climate should be monitored before burying the pipeline directly to reduce the occurrence of corrosion. Pipeline insulation layer structure is generally steel pipe, anti-corrosion layer, insulation layer and external protection pipe, reasonable selection of materials is also an important anti-corrosion measures. High concentration polyethylene outer casing is generally used for outer protection pipe. That is because the contact time between outer protection pipe and soil is the longest and the most affected by corrosiveness. We can continue to explore better materials as pipeline casing, so as to carry out anti-corrosion work. Good construction conditions and construction quality are the key to anti-corrosion. In the construction process, the welding parts of pipeline and shell should be strictly monitored, and the external thermal insulation environment should be improved. In order to improve the environment and reduce corrosion, we can use electrochemical anti-corrosion techniques such as cathodic protection and polarized metal to make the metal potential shift negatively, thus reducing the dissolution rate of anode metal.

#### 4.Conclusion

Through this paper, we have a certain understanding of the problems and solutions of heating external network. In order to make the heating project develop better and reduce the hidden dangers of external network security, we should strengthen the quality supervision and management of external network in the process of construction and operation of external network, continuously improve the quality, gradually improve the direct laying and compensation problems. So that the construction of urban infrastructure develops well, building a harmonious society and a beautiful China.

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