

Research on Pipeline and Material Optimization Design of Chemical Engineering Equipment

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Abstract: Over the past few years, China's economic development has been swift, and the economic investment in science and technology has gradually increased and it has achieved great development. Therefore, China's chemical industry has achieved notable achievements. As the chemical industry is closely connected with our daily life and plays a significant role, so to a great extent, people are increasingly concerned about the issue of building chemical engineering. During the construction of chemical engineering projects, design work is particularly important. When an entire chemical engineering project is in production, most of the substances involved in the reaction are either harmful or flammable and explosive. If these materials are not handled properly due to negligence, they will pose a serious threat to the safety and health of workers. Therefore, when designing chemical engineering projects, it is necessary to rationally design the installation of pipeline equipment and to strengthen the pre-control of related materials. In the construction of chemical engineering, the most important procedural step is the layout of equipment piping. Because it is the core device of the whole project, it plays a very important role in the operation. The quality of it will be directly related to the completion of the work of a whole chemical engineering. In addition, considering the personal safety, the design of the project is optimized to ensure the life, health and safety of each worker. Therefore, based on the basic principles of design, this paper studied the design of pipelines and materials for optimization of chemical engineering equipment and carried out a comprehensive analysis to provide a certain reference value for chemical engineering, so as to promote the development of chemical engineering^[1].

Keywords: Chemical engineering; equipment pipeline; layout; material optimization

Due to the continuous advancement of science and technology in our country, the chemical industry has gradually emerged. The construction of a good chemical engineering project will continue to attract people's attention. The design work is the most important step in the whole process of chemical engineering construction, and the relationship between the material and the pipeline should be handled well. Because many materials have strong corrosiveness, flammable and explosive, and even poisonous, if they do not reduce these substances correctly, it will bring great harm to the employees of work, and the health and safety can not be guaranteed. Therefore, in the present chemical engineering design, we will pay more attention to all aspects of the design, the layout design of the equipment pipe, the optimization design of the pipe material and the temperature, and so on. So as to ensure the quality of the entire chemical engineering, and en-sure the health and safety of the staff

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1. Piping and layout principle of chemical engineering equipment

1.1 Basic principles for the arrangement of related equipment

Arrangement of equipment can be said to be a very important part of chemical engineering. Therefore, in the construction process of chemical engineering, we must strictly deal with the layout of equipment. In general, we will follow four principles. First, choose a more suitable site. When placing equipment, we should first look for a wide and open space. As chemical engineering works, to a large extent, it produces corrosive and toxic gases. If the work is carried out in a closed environment, the working personnel will be harmed by these gases, thus affecting the health of the body. Therefore, it is particularly important to select open-air ventilation sites. At the same time, the staff must also take concrete precautions. Second, regulate the appearance of the design. If you want to reduce or avoid mistakes in the process of actual operation, then arrange the equipment and pipeline strictly, arrange all the equipment neatly according to the chemical process specification, not only can avoid the mistake, but also make people comfortable in appearance, and improve work efficiency. Third, the equipment must be arranged properly. Because in the actual chemical engineering, many different equipment will be used, in which the use is different. In the arrangement, the equipment of the whole production chain is arranged in accordance with the requirements of the design. On the basis of the reasonable arrangement, the equipment is classified according to different types. Only when the equipment is rigorously standardized, can the next production work be carried out safely and unmistakably. Fourth, the area is divided when it is arranged. The performance of different devices is not the same, so the function of the mechanical device must be taken into account in the layout and then placed in different areas. However, when the equipment is placed too much time, the condition of continuous collapse may occur. In this case, it is necessary to consider using the auxiliary equipment to support the equipment to avoid the Domino effect, so as to improve the efficiency of the arrangement and ensure the efficiency of the follow-up work. In addition, the placement of suitable ladders is also an important task. When placing a ladder, we should pay attention to balancing its direction and prevent the ladder from tilting to safety. If the economy permits, it is possible to place a ladder with a high degree of contraction, and if necessary, to handle the emergency after the ladder^[3].

1.2 Pipeline installation process for chemical engineering

Chemical pipeline is a very important equipment, so in the process of pipeline installation, we should do a good job of preparatory work, make a complete installation plan, pay attention to the installation of every detail in the installation, and then make a scientific and reasonable pipeline installation, so as to ensure the quality of the pipeline. First, the layout of chemical engineering pipelines should be scientific and reasonable, and the layout of the pipeline must be large, and at the same time, it must be far away from the equipment to be demolished. This will facilitate the implementation of operations in the later stages and be well maintained when problems arise. Instead of arranging the chemical pipelines at the corners, not to mention the lifting holes, damage to the pipelines can be reduced. Second, in strict accordance with the relevant provisions of the installation of the pipeline, because of the high risk of chemical operations, so our country in this respect will be relatively strict, and a number of relevant parameters, such as the distance between pipes and pipes, the size of the pipeline and so on. If the space is large, the distance of each pipe can be kept in the maximum range, and the original design plan of the plan is combined, and it is considered as the basic standard. The installation of pipelines is carried out in accordance with the installation sequence of the chemical engineering project, so as to prevent obstruction of the pipelines and friction problems of the pipelines during pipeline layout. Third, fully consider various external conditions encountered in the installation of pipelines, such as the welding of pipelines and the related problems of insulation between pipelines. When there is no insulation between the pipes, the distance between the official roads must exceed 5 cm at the very least. Fourth, strictly monitor the displacements that occurred during the installation of the pipelines, and appropriately increase the spacing between the pipelines. If there is no special situation in the installation, the pipelines can be directly passed through the overhead installations. If there are other pipes, then the casing is installed in the empty place and the remaining space is filled with material^[3].

2. Chemical engineering equipment arrangement with acetic acid as an example

Acetic acid is a very common chemical substance. It is used in all aspects of our lives and it exerts great effectiveness. It can also derive many different chemical substances. Therefore, it can be seen in both food and chemical industries and pharmaceuticals and pesticides. The chemical engineering of acetic acid is used as an example to further understand the process flow of its equipment arrangement. When arranging the equipment, it is necessary to follow the principle and the production procedure, and then arrange the layout of each equipment. There are generally four processes for the production of acetic acid. The first reaction is followed by distillation, followed by absorption. Finally, the catalyst is used, and then the four steps are used to partition the equipment. The first zone is the catalytic zone, because iodine will volatilize harmful substances during the reaction. To reduce the harmful effects of this substance on humans, it is necessary to set up a separate and ventilated room in the catalytic zone when the equipment is arranged. This is conducive to the loss of toxic gases. At the same time, the installation of lifting holes in the room facilitates the delivery of the catalyst during production. In the entire interval, the reaction devices of each step should be compactly arranged and these reaction devices should be placed on a steel beam of not less than ten meters, which will facilitate the work of subsequent production and overhaul work. As the production of acetic acid is more complicated, an additional installation of a steam engine and a compressor is required. When arranging these two types of medium-sized equipment, it is necessary to keep open fire equipment and non-explosive-proof equipment within a certain range to ensure the safety of the work environment. Because the production of acetic acid also involves the absorption process of the substance, according to its related characteristics, placing some devices in the reaction zone will reduce a lot of trouble for the connection work of the pipeline. In addition, fully considering the working efficiency of the staff, placing the reaction tower near the aisle, and reducing the walking time of employees can greatly improve work efficiency.

In the second process, a rectification zone needs to be installed. In this area, the most important task is to arrange the tower. When it is arranged, there are many aspects to consider. For example, the best distance between the tower and the tower should be maintained. The height of the tower, the size of the pipe, the height of the ladder should be considered in the actual situation, and the tower is best arranged. In the layout of the nozzle, the general priority should be given to the problem of tower orientation. After determining the direction, because other reactions to and from the nozzle are also important for the tray, be careful when placing it. There must be no error. Among them, there are many types of towers, of which the three towers, the dehydration tower, the dehydrogenation tower and the finished tower, are more important. In the arrangement, their diameter must be more than one meter, and in general, their arrangement work needs to be independent of the frame; at the same time, starting from the nozzles on each tower, the distance between the nozzles on each tower should be maintained at 0.8 meters or more, and the distance between the center of each tower must be greater than one meter. After arranging the equipment, it is necessary to fully deploy the orientation of the pipe nozzle. In the process of arrangement, due to the relatively high requirements, it is necessary to comprehensively understand the reaction and internal structure of each stage according to the chemical production process and process, and then reasonably arrange the pipeline ports. At the same time, it must adapt to the structure of each pipe port and place the tower design in an optimal position, not only to facilitate chemical production, but also to facilitate timely maintenance in the event of a fault. In addition, the layout of the tower platform and the ladder, the design of the tower platform, the purpose is to facilitate the opening and closing of the valve, and in the event of failure of some parts can be a good maintenance, the ladder is also the same purpose. Since the height difference between the product tower and the dehydration tower is not very large, the two towers are generally within the framework when they are arranged, so there is no need to set the platform again. However, the height difference between some nozzles will exceed a certain range, and a small platform can be added at this time. When laying out the ladder, because the orientation of the ladder is an orientation of the staff facing the tower wall, and at the same time it is inclined to a certain extent when using the ladder, the length of the ladder setting is between 3m and 10m, which is most suitable.

When the height of the ladder is higher than 12 meters, it is necessary to add some platforms to facilitate the rest on the way.

3. Optimizing the material for the selection of pipes

3.1 Choose the material for the pipeline

In the entire chemical engineering production process, there will be many different products and materials involved in the reaction. Most of these raw materials are neither toxic nor flammable and explosive. Therefore, when purchasing pipelines, we must not only consider the texture and utility of the pipelines, but also consider whether these pipelines will react with raw materials and whether they will lead to corrosion of pipelines. These need to be carefully considered. Considering the relationship between the materials and the production process comprehensively, various factors are taken into consideration when selecting materials. Not only to prevent corrosion and high temperature, but also to operate the material two times and be economically applicable, and then choose the most suitable pipe for the project, effectively prevent the pipeline damage and avoid the unexpected result of the high risk pipe leakage. Only in this way can the production of the entire chemical industry be carried out efficiently, and at the same time, the life safety of the workers is ensured. In the chemical engineering for the production of acetic acid, zirconium is widely used in it, and zirconium, which is involved in the metal material, plays a very important role in equipment containers, pipe pumps and so on. Some production companies can learn from the experience gained from production practice that zirconium is very stable in chemical properties, so it is extremely difficult to be corroded in the production of acetic acid. Of course, the selection of equipment materials also needs to combine the actual production needs, classify the properties of the material and select the appropriate pipeline, so that the production needs can be met. Some simple chemical processes like instrumentation, condensate and circulating water can be used for materials that are not very corrosive. These materials can simply use some glass or mixed steel, to a certain extent, it can save the cost of chemical engineering. In addition, it should also be based on the material to be produced by chemical engineering, and then adopt the suitable material pipeline, some products belong to acid, some products belong to the alkali, so in the production process, we should choose the pipeline that conforms with the properties of the product, so that the efficiency of the whole production will be improved and the safety can also be guaranteed.

3.2 Matters needing attention in pipeline materials

Because chemical engineering is the production of chemical substances, so when choosing piping materials, we must consider whether they have relevant properties. At the same time, we must consider the problems that often occur during the use of pipelines in the design process. That is, different products in the production process, the pressure required or the pressure produced is also different, so when the pipeline device, special measures should be taken to make different pipelines connected. After years of practice, various chemical companies have accumulated a lot of relevant experience, which also provides important conditions for the follow-up pipeline treatment pressure problems^[5].

Conclusion

In chemical engineering, ensuring safety is the most important problem. However, because of the many uncertain factors in the production of chemical engineering, a series of problems may occur. To a large extent, to prevent these problems from happening, we must choose good equipment and piping materials, and do well in the layout of piping equipment. At the very beginning, we must do a good job in the layout of equipment pipelines, and at the same time, choose the most suitable pipeline materials and arrange them properly so that we can continue to work efficiently in the entire chemical production. Although chemical engineering can bring some economic benefits for our country, but in the whole process of production, there is a great risk of safety. Once the operation is unsuitable, there may be a leak of toxic gas, flammable and explosive material spillover and so on, which will cause intangible life health damage to workers. Therefore, the primary task of chemical engineering is to ensure safety, which requires the staff to optimize the

design of the pipeline and materials of chemical engineering equipment to make the whole project avoid the occurrence of harmful substances in the greatest degree and make the utmost effort to protect the safety of life. While guaranteeing the quality of production, we must ensure life and health, be responsible for ourselves and be responsible to others. This article mainly analyzes the design and optimization of equipment pipelines and materials in chemical engineering projects, so there will be some flaws, but still hope that their own thin-sighted can provide a certain reference value, and hope that relevant departments and enterprises pay attention to such issues^[6].

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