Research on Application of Trap Valve in Oil Tank Heating

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Abstract: The steam trap plays the role in steam blocking and drainage. The appropriate trap can make the steam heating equipment to achieve the highest efficiency. To achieve the best results, it is necessary to have a comprehensive understanding of the performance and characteristics of various types of traps. This paper mainly introduces the types, principles, application occasions and characteristics of drain valves, and analyzes the types of drain valves that should be selected in the process of oil tank heating and the problems that should be paid attention to in use.

1. Trap structure
The trap must be able to "identify" steam and condensate in order to prevent steam and drain water. "Identification" of steam and condensate is based on three principles: density difference, temperature difference and phase change. According to these three principles, traps are divided into different types, namely: mechanical type, thermostatic type, and thermodynamic type.

1.1 Mechanical trap
Mechanical type, also known as float type, is to use the density difference between condensate and steam, through the change of condensate level, make the float lift to drive the valve disc to open or close, so as to achieve the purpose of steam blocking and drainage. The mechanical steam trap has small undercooling, is not affected by the change of working pressure and temperature, and discharges when there is water. There is no water in the heating equipment, which can make the heating equipment achieve the best heat exchange efficiency. The maximum back pressure rate is 80%, and the working quality is high. It is the most ideal steam trap for heating equipment in production process. Mechanical traps can be divided into different types, such as free floating ball type, free semi-floating ball type, lever floating ball type and inverted bucket type.

1.2 Thermal static trap
This type of trap uses the temperature difference between steam and condensed water to cause the deformation or expansion of the temperature sensing element to drive the valve core to open and close the valve. The thermostatic trap has a relatively large degree of subcooling, generally 15 degrees to 40 degrees, it can use part of the sensible heat in the condensate and there is always high temperature condensate in front of the valve. Within steam leakage, it has significant energy saving effect. It is the most ideal trap for steam pipelines, heat tracing pipelines, small heating equipment, heating equipment, and small heating equipment with low temperature requirements.
1.3 Thermal power steam trap
According to the phase change principle, this kind of steam trap depends on the different thermodynamic principles of the flow rate and volume change when steam and condensate pass through, which causes different pressure difference between the upper and lower parts of the valve plate and drives the valve plate to open and close the valve. Because the working power of thermal power steam trap comes from steam, the waste of steam is relatively large. Thermal power trap has thermal power type (disc type), pulse type and orifice plate type.

2. Application of Trap Valve in Oil Tank Heating
The oil and other fluids stored in the tank are heated by coils or other forms of heaters alone or used with outlet heaters to reach a certain temperature for pumping. The pipeline heater improves fuel The temperature of the oil is also convenient for combustion or process applications.

2.1 Method of heating oil tank
Three methods can be used to heat small and medium storage tanks. Firstly, place coils at the bottom of the tank, as shown in Figure 1.

![Figure 1. Oil Storage Tank-Coil](image1)

Secondly, use plug-in heater, as shown in Figure 2. In this case, a thick tube sealed at both ends is fixed on one side of the storage tank, a steam tube is inserted into it, the steam inlet is at the far end of the sealed thick tube, and the condensed water is discharged from the proximal end. But one of the most widely used methods on large storage tanks is to install a special heater to draw steam from the annular steam main pipe in the middle of the tank.

![Figure 2. Oil tank-plug-in heater](image2)

The third method is to install a special heater, which is the most commonly used method for large oil storage tanks: the steam is drawn from the annular steam main pipe in the middle of the tank, as shown in Figure 3 and Figure 4.
2.2 Selection of traps under different heating methods

2.2.1 Coil
There are many types of coil structure, and it is important that each tube group or heater is drained separately. Because the condensate must be discharged along the coil, the long coil is prone to water hammer, so the coil is designed to gradually drop along the steam flow direction. A float-thermostatic trap is installed to resist more serious water. Hammer phenomenon, but when the water hammer phenomenon is quite serious, you need to use an inverted bucket trap or pressure balance trap. Installing heat preservation on the outside of the float trap can prevent freezing damage, while the inverted bucket trap needs to be installed in parallel with an air exhaust valve to facilitate the removal of the air in the coil during the start-up phase.

2.2.2 Plug-in heater
Plug-in heaters can be divided into two types, oil preheaters and outflow heaters. Oil preheater: These are some single-stage or multi-stage heat exchangers, which are similar to outflow heaters. Each stage is drained separately. It is usually installed indoors and will not freeze. Therefore, the float-thermostatic trap is best choice. Outflow heater: The outflow heater is a shell-and-tube heat exchanger installed in the storage tank. When the oil is pumped out of the storage tank, it is heated on the spot, usually with an automatic temperature control device. A self-acting temperature control system is installed at the oil outlet to control the supply of steam. The first option is a float-thermostatic trap. When exposed to the external environment, heat preservation should be installed. Generally, the condensate is easily contaminated by grease, and the condensate is directly drained. If you want to recover the condensed water to the recovery main pipe, it is recommended not to rely on its own pressure to increase, otherwise it is likely to cause water accumulation and water hammer at low load. This kind of working condition can be installed with a trap pump.

3. Conclusion
Compared with the whole steam system, the steam trap is a very small part, but whether the steam trap works normally plays an important role in the energy consumption of the steam system. Generally, in
the transformation of a system, the cost of steam trap accounts for 7% - 10%, and its contribution to the energy saving effect of the whole system reaches more than 40%. In order to improve the efficiency of the system, according to different applications and working conditions, we should choose the steam trap with reliable quality and appropriate model, and correctly install it, pay attention to daily maintenance and regular detection, so as to achieve the best energy saving effect.

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