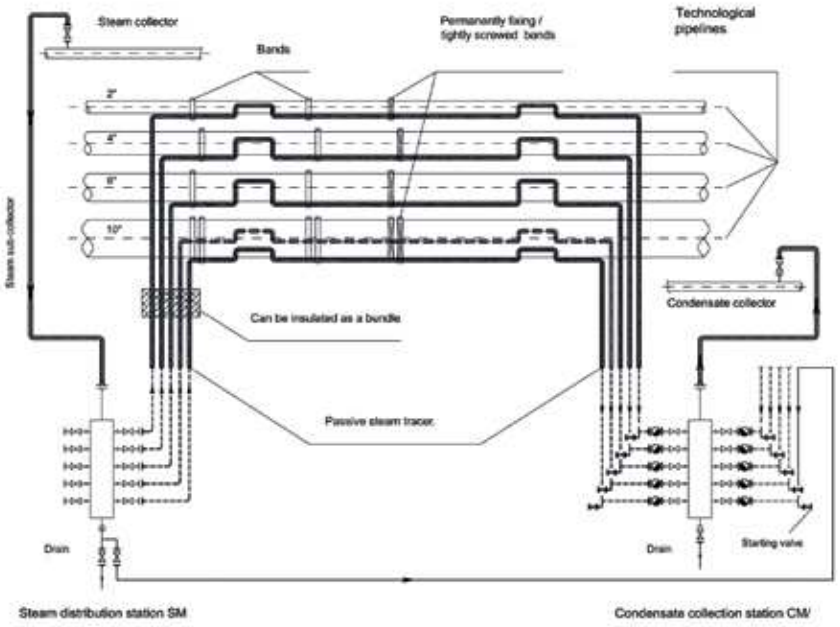
A design challenge

A multitude of hardships and challenges need to be taken into account when designing steam trace systems

Heat tracing systems, also called satellite systems play an essential role in the correct functioning of industrial installations. Technical solutions that guarantee safe working of the installation should be linked to the economical side of the problem. Because of the ever-increasing price of energy expenditure, it is necessary to maximise the possibilities of reducing energy costs by imposing optimal temperature control solutions. Nowadays, temperature regulated heating systems as well as steam distribution and condensate collection systems should be optimised.

Heat tracing systems protect installations against low temperatures in autumn-winter conditions and ensure all year long that the transfer of the products takes place at the lowest resistance of flow, that is the lowest viscosity of the transferred medium. Heat tracing systems can be electric (considered twice as expensive as a steam heating system), hot water heating (not so effective), hot oil systems (require very good leak-tightness at the system and problematic), or steam systems.

Steam is easily accessible in most industrial plants, and in steam tracing systems it serves to replenish heat loss of the transferred product. Steam at the correctly selected pressure ensures product temperature at the right level, i.e. it guarantees that the temperature of the transferred medium will not drop below the temperature assumed by the process engineer. Steam is incombustible, does not pollute the environment, and is characterised by high convective heat-transfer coefficient. These characteristics make steam the main heating medium for trace heating systems.



A steam tracing scheme

Challenging design

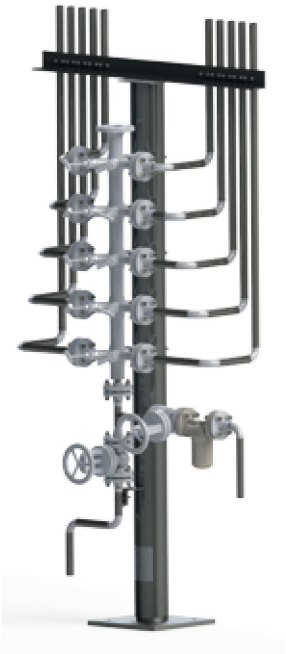
Anyone who designs steam tracing systems knows how problematic and complicated it can be. The practical side of steam tracing construction is based on assembling many steam tracer sections at the same time and connecting them (in logical and effective way) with steam distribution and condensate collection points, which must be also connected to the main steam and condensate pipelines. This global issue requires knowledge and experience about recommended lengths of steam tracers, type of insulation, compensation, standards of valves, pumping and regulation system heating, etc.

Another extremely important issue is correctly addressing the whole installation to ensure easy and effective maintenance in the future. Satellite systems of many installations might consist of several hundred heating loops. A detailed marking of each loop is therefore very important. Each heating loop should be marked at the beginning, that means the steam distributor, and then at the end, or the condensate collector. It is important that the markings on steam trace heating pipes are the same during designing, installation, and operation of the particular installation.

During the design of the satellite system, the main decision we have to make is the choice of steam pressure, which determines the saturation temperature. It is true that we often depend on the

A steam tracing system installed in Poland

ZFM – Zamkon condensate collection station



RFM – Zamkon steam distribution station

parameters of the steam available on a particular installation. According to the laws of thermodynamics, the lower the steam pressure, the higher the heat of condensation, leading to lower absolute steam consumption. At the same time, however, higher required product temperature leads to higher heating steam saturation temperature, and therefore higher steam pressure.

What to do

The first step in the design process is calculating the energy balance of all heat losses in the whole heating installation. Based on the required product temperature, heat transfer coefficient, and the thickness of the insulating material, as well as the lowest ambient temperature, we can calculate the heat loss per a metre of pipeline. Through this method, we can calculate one by one the heat consumption of each loop of steam trace heating pipe. Adding up the heat losses of all the loops, we will get the maximum global heat consumption for the whole heating installation as t/h.

While designing a satellite system, an extremely important issue is the selection of the right type of steam trap. Many mistakes have been made in this area, and as a result, problems with keeping the correct product temperature have occurred. The inverted bucket steam trap is certainly the best recommended type for satellite systems. It can work for many years without steam losses, without any restrictions concerning steam pressure at low, medium, or high pressures. It needs only to be remembered that the steam trap should have an internal check valve.

Thermal bimetallic steam traps can be also used, but mostly at medium and high steam pressures. Steam pressure at or above 3 bar is assumed as the lowest acceptable operating point. At lower pressure ranges (<2.5 bar), the steam trap may experience perturbations, especially when colder condensate is constantly present on the outlet side. The saying "bimetal behaves strangely at lower pressures" is often heard among Polish operators.

Conclusion

Zamkon is a Polish manufacturer of industrial fittings, specialising in steam tracing systems. The standard of the company's steam tracing business is building its own modern RFM (steam distribution) and ZFM (condensate collection) stations. At the heart of these systems is always a manifold made from steel forging modules. It lengthens the systems' operating life and enables them to save required space by up to 50%. This solution also enhances the aesthetical aspects, which today are also taken into consideration during designing new installations.

It is also important that the built-in on/off valves are replaceable, including valve seats, as it allows for quick replacement without the need of either the station or individual elements being disassembled. Zamkon offers the above mentioned stations as a complete device ready to be installed at the destination point. They contain all necessary equipment, including the manifold with on/off valves, drain valves for start-up and later maintenance, steam traps, flanges, column, etc. This solution is also very attractive during the system assembly, because the stations are prefabricated at Zamkon's factory and delivered as a packet, tested and certified. Zamkon cooperates with all chemical plants and power and plants in Poland as a supplier or a design company. During the last few years, the company has also engaged in projects abroad and it continue to develop its activities outside Poland.

For more information:
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