

TECHNICAL REPORT



TEMPERATURE CONTROL SYSTEMS IN THE PHARMACEUTICAL INDUSTRY

The pharmaceutical industry is an essential part of the global healthcare sector. It develops medicines to treat and prevent diseases. Medicine has made remarkable progress throughout its history. With meticulous research, scientists are able to isolate, reproduce, and provide chemicals and proteins from plants and animals in the form of drugs.

Modern scientific and technological advances are accelerating new discoveries and the distribution of innovative pharmaceuticals with optimized therapeutic effect and few side effects. Molecular biologists and pharmacists are continuously working to improve the benefits of medicines and thus their efficacy. However, these highly complex manufacturing and further processing methods always require optimum technical conditions. This is the only way to ensure the manufacture of a high-quality and, above all, safe pharmaceutical product. This applies to all instruments, incubators, and every sample – at any time and every day. For example, temperature deviations of even one to two degrees can under certain circumstances destroy years of research.

THE CRITICAL ROLE OF TEMPERATURE CONTROL IN THE PHARMACEUTICAL INDUSTRY

Pharmaceutical manufacturers use a variety of methods to achieve this temperature control. However, from extrusion and melt extrusion systems to mixers and jacketed vessels, all of these systems and vessels have one thing in common: they always involve highly sensitive processes. Due to their chemical properties, drugs are usually more sensitive to temperature stress than many other consumer products.

Precise temperature control during chemical and enzymatic reactions has a strong impact on the end results – not only in manufacturing, but also in research. In many research laboratories, temperature control systems therefore ensure stable and precise conditions.

Temperature control devices are characterized by precisely this accuracy, which can be easily reproduced for other drug manufacturing processes. An accuracy that is essential for producing high-quality products. This is because active pharmaceutical ingredients (APIs) often react adversely to temperatures outside a certain tolerance range. Only by maintaining a constant and accurate product temperature and monitoring it throughout the production process can a pharmaceutical processing plant achieve the highest quality. In addition to manufacturing and preparation, the filling, packaging, transportation, and even labeling of drugs are also subject to strict regulations and rules.

TEMPERATURE CONTROL USING THE EXAMPLES OF MELT EXTRUSION AND COOLING

Melt extrusion is used, for example, in the pharmaceutical production of solid oral dosage forms. This procedure enables the delivery of drugs with poor solubility. Poor solubility is a major challenge in the pharmaceutical industry and causes drugs to have poor bioavailability. The method uses pressure, movement, and temperatures between 120 and 180 degrees Celsius to mix the various ingredients and optimize their solubility.

The materials are fed into an extruder via a hopper and melted by means of a screw or twin screw, which is heated by the frictional heat and by heating elements. At the same time, the twin screw extruder mixes these elements so that the resulting particles can be combined and filled into capsules or pressed into tablets. Precise heating control is essential in this process, as too high temperatures can cause important ingredients or active agents to dissolve, which in turn negatively affects the efficacy of the end product.

In order to achieve temperatures as low as -78 degrees Celsius for cooling, dry ice is often used. However, this cooling process has several disadvantages and, especially on an industrial scale, is much more complicated. For example, temperatures cannot be precisely adjusted and controlled. In addition, there must always be enough dry ice available and laboratories must plan ahead accordingly, which limits their flexibility. Compressor-based cooling probes ensure precise cooling that does not require ice. Cold burns for the user can thus be prevented and experiments can even continue unattended overnight.

CONCLUSION

Whether it's throat pain or headache tablets or other medications, temperature control has a direct impact on the quality of the pharmaceutical product. Precise temperature control not only affects the chemical and physical stability of the drug, it also ensures that the active agents contained are evenly distributed throughout a patient's body over a certain period of time, thereby achieving their full potential.

From laboratory research to production, we offer all the temperature control systems necessary, which can be tailored to individual requirements. The flexible systems can be adapted easily and operated intuitively with our modular accessories. Thanks to precise adjustment options for each variable, they create the ideal conditions for high-quality pharmaceutical end products.

Not all applications, however, can be temperature controlled with a standard solution. Existing systems may need to be upgraded and expanded. Our Solutions Business Unit (BUS), with its own in-house development team of engineers and designers, specializes specifically in optimizing or modifying existing equipment designs to meet individual customer requirements. Our many years of experience and our flexibility provide the perfect basis for meeting exceptional requirements. They also enable us to keep breaking new ground. Your vision is our driving force. This produces impressive results.

Please contact us if you have any further questions or would like an in-depth consultation. We would be happy to work together to find a solution that fulfills your wishes and needs