Technical article, published in:
Der Konstrukteur 10/2015

Door shut for cool processes

Solenoid interlock in a deep freeze system for blood plasma

The doors of a plate freezer which, through contact cooling, cool down freshly obtained blood plasma to a core temperature of -30°C in no time are monitored reliably with solenoid interlocks. In this case, the safety switchgear units serve not so much as a means of personal protection but process safety instead.

The function of many machine and plant systems of processing technology is not obvious. This also applies to plate freezers from L&R Kältetechnik GmbH. The company develops and builds systems that provide cooling and deep refrigeration to -120°C – not only for companies that process plastic and metals but also for highly sensitive applications, e.g. in processing technology and pharmaceutical production.

Shock freezing of blood plasma

The plate freezer was made following a request by a manufacturer of pharmaceutical products on blood plasma basis. These liquid, cellular-free elements of blood are used to gain blood clotting agents and vaccines. To obtain the effective substances, the plasma, which is packaged in pouches with a capacity of 6 to 8 l, is cooled down over a specific timeframe to -30°C and stored at this temperature until it is needed.

The combination of temperature and cooling down time demanded by the user can be referred to as shock freezing. This means: It is not sufficient to just generate cold. The cold must be introduced into the product in a targeted way – through contact cooling. For this reason, the L&R engineers developed a system with two cooling cells, each one comprising seven contact plates in successive order. The plasma pouches are inserted between the plates that have coolant flowing through them. Once the cooling cell is completely loaded, a cylinder moves out and pushes the pouches against the contact plates under controlled pressure. In this way, the transfer of cold is considerably slower and more effective and thereby faster than with pure airflow.

Cleanliness and process reliability

Aside from the speed of cold transfer, the demands on this project were also high. Christoph Wiemer, sales manager of special plant construction at L&R Kältetechnik: “The system is in a production area of clean room class D. We had to take account of good manufacturing practice, which goes without saying in the pharmaceutical industry. Furthermore, simple, thorough and residue-free cleaning was necessary – which just in terms of the extensive electrical equipment was a real challenge.” Moreover, the L&R engineers had to ensure process reliability: “Assurance must be provided that the door can only be opened during the deep freezing process in the event of an emergency and after the control system has been released.”

Wanted: Hygiene-orientated interlock

It was therefore obvious that the two doors needed to be secured via an interlock. And the additional requirement of this interlock was: Since the switchgear units cannot be attached in the deep freeze chamber, they must be mounted on the outside of the plate freezer and be of an appropriate hygienic standard as well as exhibit a high degree of safety.

For employment profiles of this kind, the Schmersal Group developed the AZM 300 solenoid interlock. The new type of holding mechanism, with prominent cross-shaped

01 The solenoid interlocks were developed, among other things, for sensitive areas of application in the food product and pharmaceutical industry

interlock, facilitates – in combination with protection type IP69K – simple cleaning and prevents the build-up of dirt. Using safety-orientated RFID sensors, the integrated electronics of the AZM 300 unit monitor not only the position of the locking bolt but also the position of the safety door itself. The respective safety sensors were developed by Schmersal in-house.

Practical solution

In terms of safety, L&R has integrated the interlock in such a way that the door is held closed while the freezing process is in operation. The evaluation electronics assigned to the AZM 300 unit are housed in the switch cabinet integrated in the compact plate freezer. The actual switch cabinet construction from L&R ensures a high level of electronics competency.

The cross-type interlock principle of the AZM 300 unit makes it possible for the interlock to be mounted and adjusted very easily. Furthermore, the same model is used on both doors with left and right stop.

02 Both doors of the cooling cells are held closed by AZM 300 units respectively while the blood plasma is shock frozen by means of contact cooling

The designer can dispense with other constructional elements such as stops and latches, and the latching force – i.e. the non-safety-related latching force – is adjustable.

Process safety at the forefront

Unlike most of the other applications of solenoid interlocks, the emphasis with the plate freezer is not on the protection of working personnel but on the product and process instead. Christoph Wiemer: “The consequence of the cooling cell door being opened during the cooling down process could be not only heavy icing up of the cells from air humidity but also the whole batch being rendered unusable due to it not cooling down quickly enough. It was necessary to avoid this at all costs.”

And the L&R engineers solved this task well with the aid of the AZM 300 solenoid interlock. Even if by definition it is “just” about process safety here, this function can ultimately improve the health of many people and in extreme cases even save human lives. Blood plasma, from which e.g. blood-clotting agents for haemophiliacs are obtained as well as blood and vaccinations as immediate protection against rabies and hepatitis B, is a very valuable and scarce base material for the pharmaceutical industry.

From a unique product to series production

The first plate freezer developed by L&R has already been supplied and is working to the customer‘s complete satisfaction. The second system of this kind is already being manufactured for another company in the pharmaceutical industry. The prospects of the newly developed unique product achieving (small) series production are therefore good. With the second plate freezer, the target temperature of -70°C is even lower – and it is likewise fitted with AZM 300-type solenoid interlocks.

03 The system has a compact design, is hygienic and suitable for operation in small rooms

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