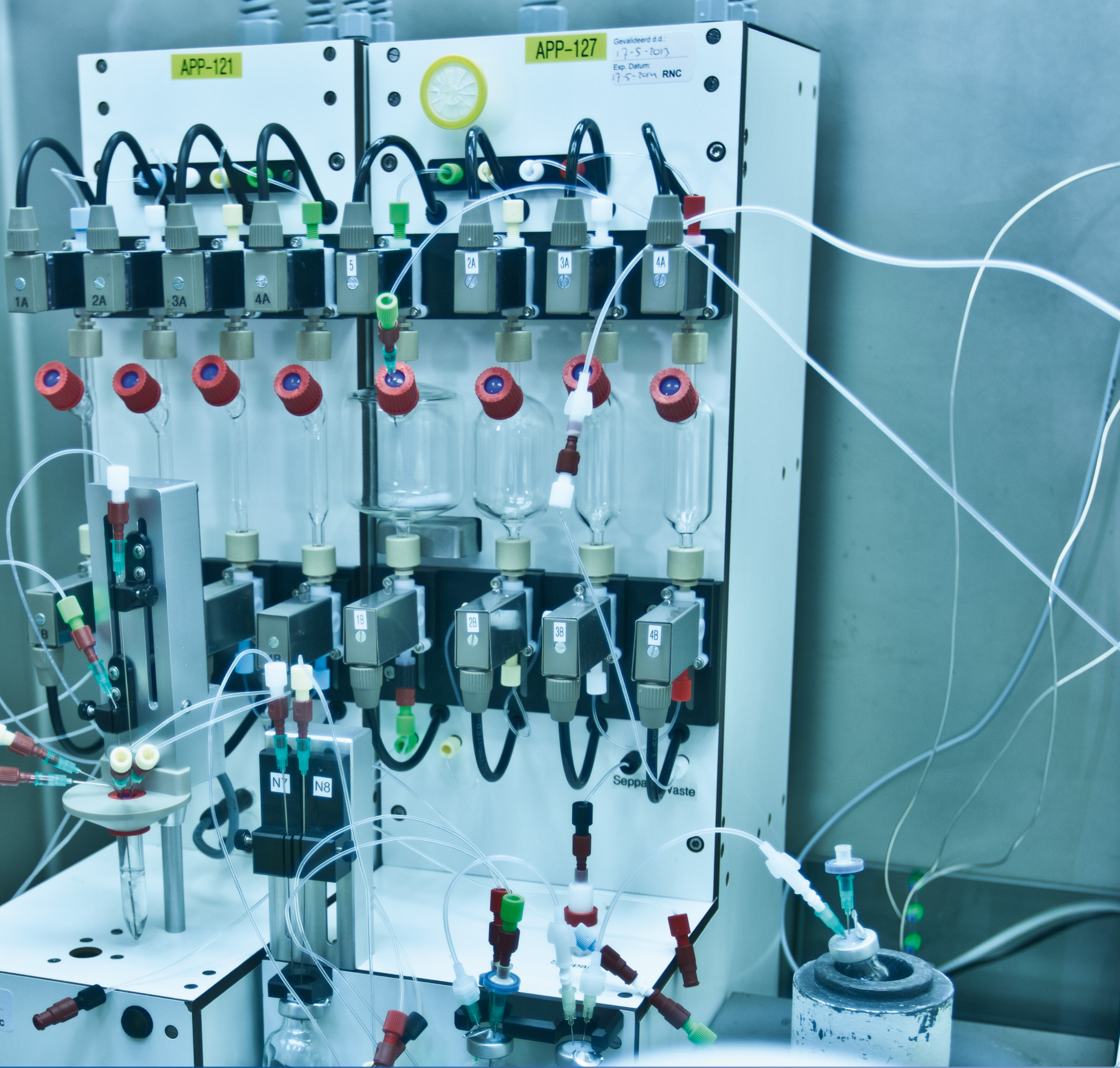

VUMC AMSTERDAM

Bürkert solenoid valves prove themselves in the production of PET tracers

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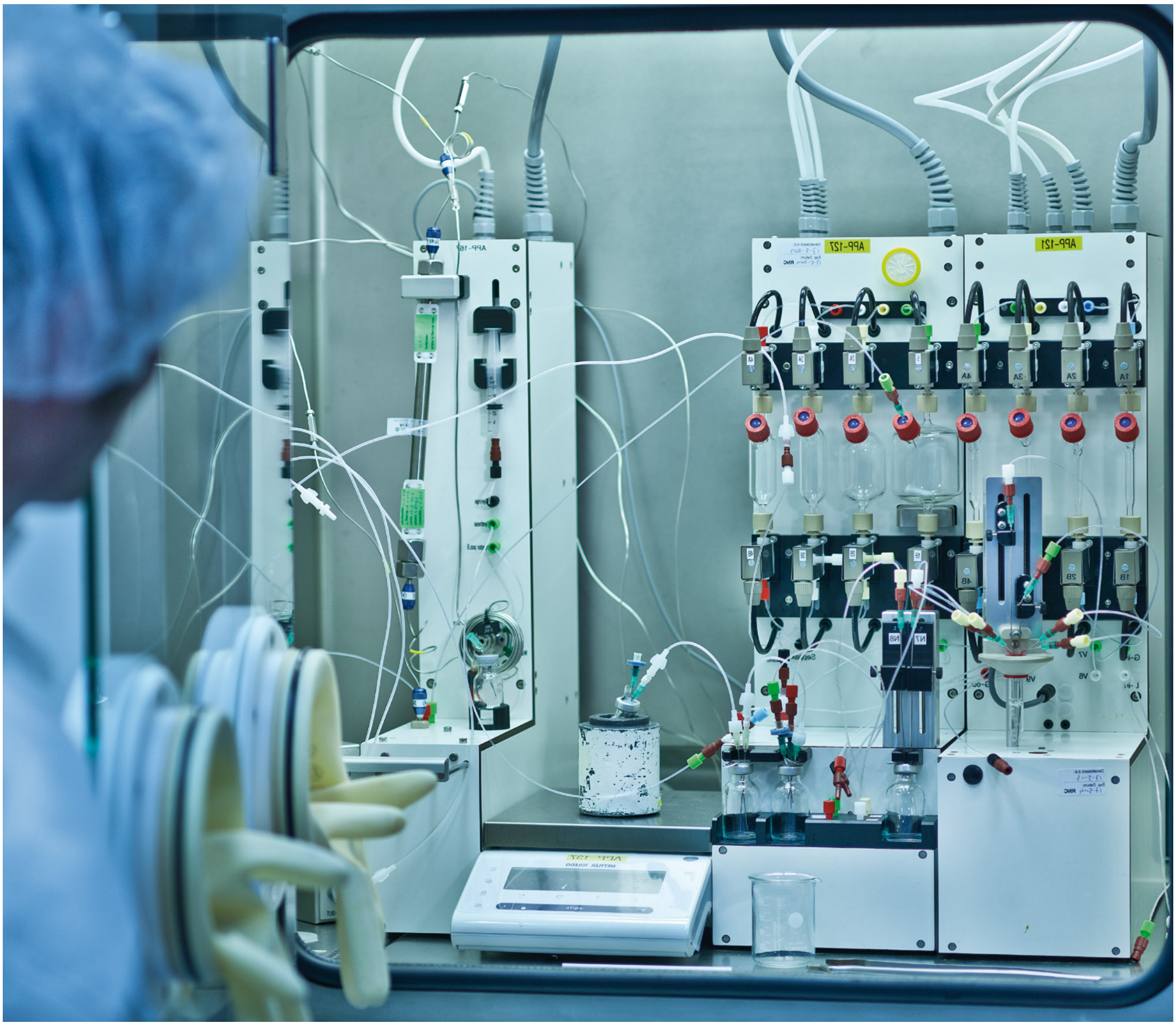
Big research with small valves: Bürkert solenoid valves prove themselves in the production of PET tracers

The VU University Medical Center (VUmc) in Amsterdam is a renowned research institute for oncological diagnostics, i.e. the detection of tumour diseases. The tumours are detected by means of medical tracers for the analysis of metabolic processes.

For the production of radioactive tracer substances the institute has been using Type 0127 solenoid valves from Bürkert for nearly ten years.



Instument shielded by lead glass

The synthesis process is controlled by valves

Positron Emission Tomography (PET) is used to visualise and characterise biological processes in the living organism. The complex and costly procedure exists for a serious purpose: the precise diagnosis of cancer diseases. In this procedure, dysfunctions or pathological changes are made visible by means of disease-specific, radioactive marked substances, or PET tracers. Molecular imaging facilitates planning of surgical operations by allowing the surgeon to identify the exact position of the tumour in the body. It is possible to differentiate between benign and malignant tumours, to localise metastases and to monitor the success of treatments. Since the radioactive PET tracers have short half-lives, they have to be produced at the location where they are needed. This requires reliable technology down to the last detail. For production of the radioactive tracer substances, research institutes such as the VUmc in Amsterdam require their own cyclotron. A cyclotron is a circular accelerator consisting of two D-shaped chambers. An alternating acceleration voltage applied between these two chambers is traversed by electrically charged particles, increasing the acceleration with each cycle. For this purpose, a magnetic force bends the particles into a spiral path. The production of PET tracers uses radioactivity that can exceed 100 GBq (Gigabequerel). The entire synthesis must therefore take place in an automated process with insulators shielded by lead and lead glass. The VUmc uses isotopes and tracers with a relatively short half-life of less than twenty minutes. Time is therefore an important factor in the lab, to ensure that there is sufficient material available for the subsequent examination. The tracers at the VUmc are used only for diagnosis purposes within the framework of cancer research conducted there.

Lab personnel operates behind thick lead doors

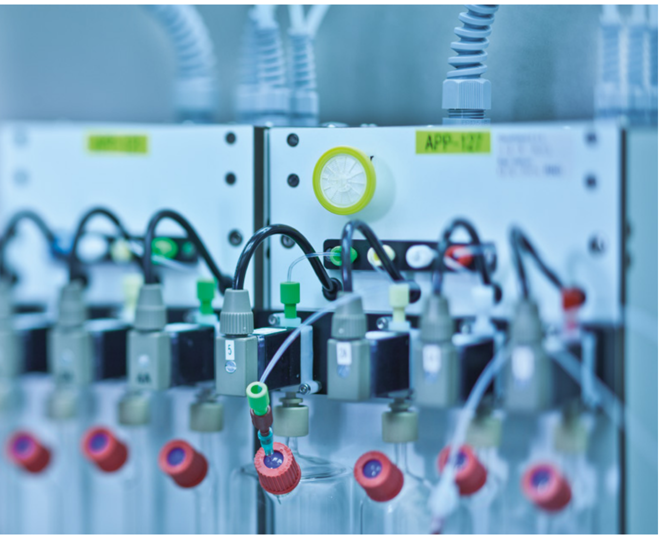
High precicion everywhere

Handling of highly radioactive substances

The analysis and processing of the molecules produced takes place in a complex automated lab process machine, which is located in a “hot lab” operated in according with GMP (good manufacturing practice). Such a lab is used for examination of the chemical and physico-chemical properties of radiation-exposed nuclear fuels. Handling of radioactive drugs or working with open radioactive substances must always take place in nuclear medicine facilities, in a specially designed hot lab. The principles for the design of a hot lab are defined for example in DIN 6844. Radiation safety and occupational safety in general play an especially important role here, of course, which is why a hot lab is divided into separate, shielded sections for the individual steps of the procedure.

Custom-designed flexibility

The accelerators in the research institute are used to produce numerous different tracers. The VUmc therefore designed and built a custom instrument, since the conventional models can produce only a few different tracers. The design of such a system requires close cooperation between engineers, cancer researchers and chemistry experts. Due to the stringent quality requirements, various process steps for tracer production are controlled by Bürkert Type 0127 solenoid valves. One instrument uses 22 valves. Although they perform their mixing, heating, cooling, filtration and concentration tasks inconspicuously in the background, these functions play an important role in the process. Bürkert valves have been in use at the research institutefor about ten years and Fred Buijs of the VUmc is very satisfied with the quality: “Why should we look around for other valves? The Bürkert valves are excellent, both in terms of suitability for the application and top quality.”



Valves operate fully automated

Control unit

Forerunner among miniature valves

The Type 0127 solenoid valve, as a 2/2-way or 3/2-way valve is considered the forerunner among the media-separated miniature valves and is ideal for use in lab, medical and analysis technology. The rocker technology that actuates the separating membrane between the drive and the fluid has set standards. The valve, which features protection type IP54 as well as high resistance to chemicals, controls even minimal volumes with very high precision. The temperature generated by the coil is minimal, as is the internal volume. The valves feature excellent flushability, with practically no dead zones. The Amsterdam research institute uses a special version of the 2/2-way valve in which the fluid chamber was miniaturised even more to achieve an internal chamber volume of only 20 microlitres. The developers at the VUmc insist on especially high-quality materials, such as ETFE (ethylene tetrafluoroethylene) as the body material and FFKM (perfluoroelastomer rubber) as the seal material. The valves are connected using UNF threaded connections because they are easy to disconnect and create no dead zones. The customisation of this valve is a good example for the high solution potential of the Bürkert portfolio.

Flawless work under time pressure

Since radioactive materials are in use, the computer-controlled and fully automated lab system operates behind thick lead doors and lead glass windows, to minimise the interaction of the lab personnel with the instrument. The entire process is therefore mapped in software. The valves are controlled via voltage pulses. A software-controlled drop in the voltage results in closing of the valve. The machine needs about 60 minutes to complete all synthesis and formulation steps, after which the prepared reagent is ready for use on the patient. The substance is then injected into the patient and a PET scanner creates images of the patient. The images clearly show the areas in the body where the radioactive material has concentrated. Three samples are created during the process: One is injected into the patient, another is analysed to obtain approval for use in the patient and a third is tested for sterility. All three samples are produced in the instrument and packaged at the same time. Then they are transported to the patient and the lab. As soon as the sample has been analysed, the doctor performing the research is notified so that he can carry through with the injection. The short half-life means that everyone has to work under extreme time pressure. Nevertheless, every step in the process has to happen smoothly and without any errors. PET diagnosis is very complex and costly; however, it allows researchers to more closely examine metabolic processes in the human body and to better understand how cancer originates, in order to better treat the disease. Bürkert solenoid valves do their part in contributing to this research.

"Why should we look around for other valves? The Bürkert valves are excellent, both in terms of suitability for the application and top quality."

Fred Buijs, Designer / VUmc Amsterdam

You can find out more about this project at:

www.buerkert.com

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