

Roller Bellows Seal MF90 in Methyl Methacrylate

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At Ibach, a stone conservation plant in Bamberg/ Germany, the previous sealing system in an autoclave was successfully upgraded to a roller bellows seal MF90. The seals have been running to the full satisfaction of the customer. A particular challenge of this application is the medium which hardens during the process, also in the area of the seal.

Process

Ibach has developed a process to preserve historical valuable stone monuments in their original state. This process is called acrylic total penetration process. The first step of the procedure itself is to dry the item carefully but thoroughly. The duration of the drying process is 50 to 2,500 hours, depending on the type of stone, the extent to which it has weathered and the effect of previous treatments. If necessary, vacuum drying is used to reduce the drying time by 30 %. After the porous objects are completely impregnated with liquid methyl methacrylate (MMA), heat is introduced to make the MMA cure, polymerise into acrylic glass ("Perspex").

Operating conditions

Media: Methyl methacrylate (MMA) and conservation agents

Operating temperature: 70 °C (at 0.8 bar abs.)

Operating pressure: Vacuum 0.2 bar abs. (extraction of the air from the capillaries) and 12 bar (impregnation phase with MMA)

Speed: 1,200 min⁻¹

Equipment and seal

Equipment: Vacuum autoclave with ventilator

Seals incl. materials: MF90S1/35-E1, Q12Q1VM5G

Quench: Water with continuous flow

Problems with the previous sealing situation and the solution:

The originally applied seals, PTFE packings, always failed after a very short time. The reason for that is the process medium which penetrates into the packings, cures and then destroys the seals.

Also for the mechanical seal this medium poses a particular challenge. Most of the elastomers swell after a few minutes if they get in contact with MMA already at room temperature. Besides the process medium also penetrates into the seal and cures, especially in the area of the dynamic O-ring. Therefore a pressurized dual seal would be the best choice, but a costly rebuilt of the ventilator would have been necessary. Thus a metal roller bellows seal MF90 with a quench at the atmospheric side and a Buramex® packing ring at the product side was selected. The product side packing ring was taken over from the previous seal design at the request of the plant operator to protect the mechanical seal in some respects against the medium. The seal is designed as a ready to assemble cartridge unit to allow an easy and fast installation by the plant operator. Beyond this, HS-grooves are added as special feature to improve the lubrication of the seal and thereby increase the lifetime.

The described sealing concept has been successfully in operation since 2007. The service lifetimes could be drastically increased and the extensive exchange of the seal has been reduced to a minimum. This has led to a significant reduction of the maintenance costs of the equipment.

