

# Creative Service Solutions

A paper mill in Finland suffered the complete failure of a large four-stage vacuum blower. Creative problem solving resulted in a repair time of only seven days. The maintenance team built a functional blower by using parts from three outdated machines. The combined efforts of Sulzer and of the paper mill's own engineers made it possible.



1 A modern paper production installation.

The paper industry has to cope with a remarkably strict production timetable. Shutdown periods for maintenance have to be limited in number and duration. The maintenance manager at the paper mill contacted the Sulzer service center in Finland and explained the emergency: The compressor for a vacuum blower was heavily damaged. Immediately, the service staff sent an expert from the Rotterdam Service Center, Netherlands.

## Fast response time

Sulzer sent a compressor engineer to inspect the failed vacuum blower, to make recommendations, and to support the maintenance engineers of the mill. At the paper mill, a Sulzer four-stage radial vacuum blower was operating with a second unit on a stand-by basis. The two vacuum blowers are used to remove water vapor and dry the paper. A control valve which enables the operator to switch from one

vacuum blower to the other failed following a power failure. The resulting leak in the valve caused the standby vacuum blower and connected oil pump to run backwards. The resulting lack of lubrication had a catastrophic effect on the bearings and rotor. The labyrinth seals were destroyed and the casing was damaged. The gearbox bearings and gears were damaged beyond repair and needed to be replaced (Figs. 2, 3, and 4).

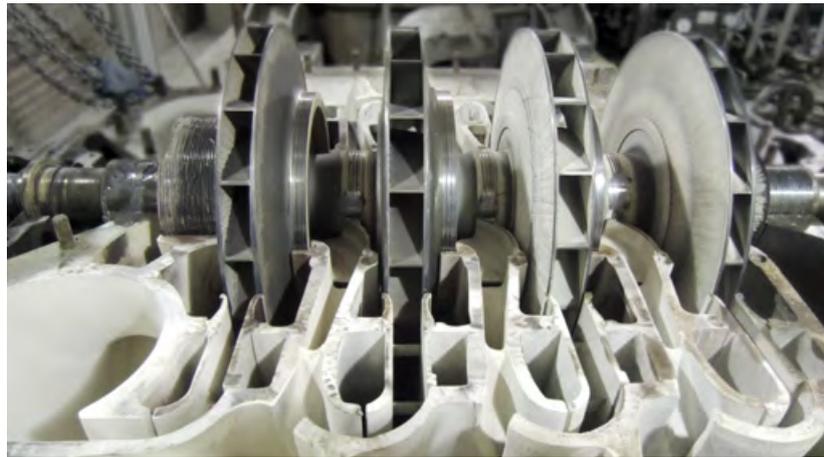
### Recycling outranged machines

The repair team was under pressure to get suitable spare parts in time. A maintenance engineer at the mill came up with a creative solution. The mill owner had two other paper mills that had been mothballed but not decommissioned. Some older machines were stored there — they contained equipment that could be used for the repair. The Sulzer engineer inspected three of the idle machines and recycled the most suitable parts from each machine in order to create one operational vacuum blower. The donor machines had been inoperative for two years. It took some time to remove corrosion, but the repair team was able to make the components fit for reuse.

### Rapid repairs and commissioning

The compressors used in these paper mills have been in operation for over 50 years. During the rebuild of the parts, the team encountered further complications. The damaged 800 mm diameter rotor and the only available replacement had different dimensions. Having identified a potential replacement four-stage casing, closer inspection showed that the diffuser air-flow openings were not the same as those in the damaged casing. The maintenance engineers found another smart solution: a replacement casing was identified in a different redundant plant and shipped overnight to the paper mill. The identity tag of the refurbished rotor showed that it had been installed previously in this old casing.

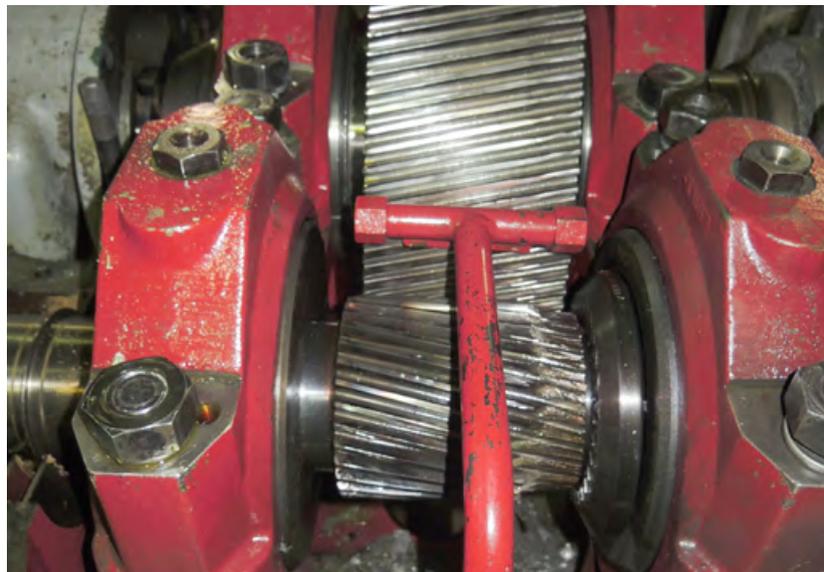
At the same time, the gearbox was rebuilt using parts from other vacuum blower devices, and the unit was checked for clearances. The spare rotor was installed and checked for run-out tolerances. It had a maximum of 0.03 mm at the shaft center and 0.00 mm at the bearing. The compressor clearances were also checked, along with the labyrinth clearances, and they were adjusted to fit. The lubrication system was flushed and cleaned before the motor and gearbox were installed and laser aligned. The client's maintenance



2 Compressor opened after the crash.



3 Shaft and balancing piston labyrinths.



4 Heavily damaged gearbox.



5 Repaired in Rotterdam – the rotor with one new impeller.

engineers then started the recommissioning of the compressor. Before returning the plant to normal operations, they checked the control valve precisely to allow correct operation. Production in the paper mill restarted after only seven days despite the many difficulties during the repair.

### Precise rotor refurbishment

In the spare parts stock, the paper mill had a spare rotor that fit the rebuilt compressor. Unfortunately, it was stored with a damaged impeller. This spare rotor was sent to the Rotterdam Service Center, where it was refurbished and repaired before being returned to the customer's spares inventory as a serviceable component (Fig. 5). The process of manufacturing a new impeller involves digitizing the original impeller and creating a 3D model that is used to generate a set of manufacturing drawings. The certified base material is machined, stress relieved, and welded before being tempered. After final machining, non-destructive testing (NDT) is carried out along with a dimensional check and low-speed balancing. A spin test is run at 115% of the nominal working speed. Finally, a last NDT inspection and a dimensional check are completed before the refurbished components are reassembled.

In addition to the new impeller, the Rotterdam Service Center manufactured new thrust disks, renewed the labyrinth seals, and repaired two bearing journals by laser welding. Having completed all this, the rotor was reassembled, checked for balance, and sent back to the client. The original impellers were riveted but the manufacturing technology has developed further since then. The new impeller was manufactured by welding the shroud to the hub before balancing it.

### Training and preventive check-ups recommended

In this particular application at the paper mill, the water vapor caused corrosion inside the vacuum blowers. To avoid such heavy crashes, Sulzer recommends preventive inspection of the turbomachinery equipment on an annual basis. After the inspection, customized refurbishment takes place to maintain reliable operation. Sulzer offers turbomachinery training courses to ensure that customers understand the maintenance requirements and working principles of rotating equipment. These courses run either at the customer's site or at Sulzer's manufacturing and service centers around the world. Another option for customers is to book a hands-on training course at the Sulzer Academy in Bruchsal, Germany.

### Team spirit made fast response possible

The Sulzer engineers and the client's personnel worked tirelessly. They refurbished and renewed a variety of components that were harnessed together to create a fully functional compressor.

Peter van der Wal, General Manager at Sulzer's Rotterdam Service Center, says, "This has been an excellent example of how we can respond to a client's call for assistance. It was so important for the client to have his plant running again as fast as possible. Together with the customer, we have achieved this goal despite the challenging circumstances. It is a good feeling to have such a positive, cooperative team spirit with our customer. The international setup of Sulzer and solution-oriented thinking is the foundation for the success of this repair. Our organization is set up for a smooth workflow among the service centers around the globe. The local Sulzer service center in Kotka, Finland, and the service center in Rotterdam, Netherlands, worked together perfectly thanks to the Sulzer team spirit."

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