Philips values performance, reliability of intensive batch mixers

Glass-making operations in China are case in point.

Netherlands-based Royal Philips Electronics counts itself among the giants in electronics. It is a global leader in color television sets, lighting, electric shavers, as well as medical diagnostic imaging and patient monitoring. It is also Europe's largest electronics company, with worldwide sales of €31.8 billion in 2002.

Philips operates in more than 60 countries and has 164,000 employees. About 60,000 of them are in Asia, and 50 percent of those are in China. In fact, the Asia-Pacific region accounts for 21 percent of global sales, and the company forecasts sales there will reach 30 percent in 10 years.

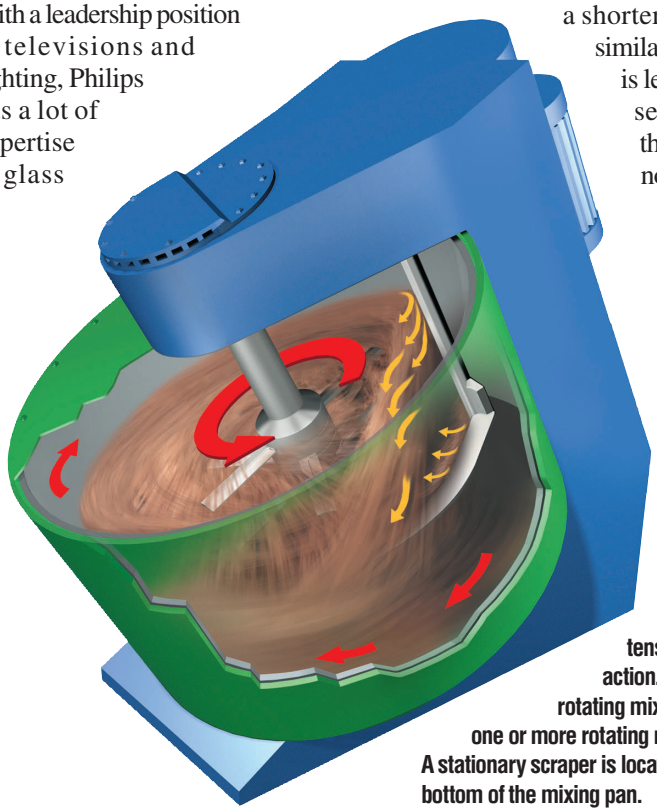
A large part of that growth will come from China, where Philips is among the top three players in the marketplace for color televisions, medical systems, and optical storage. The company also has a leading position in lighting, shavers, electric irons, LCD monitors, and mobile display systems.

The wisdom of experience

With a leadership position in televisions and lighting, Philips has a lot of expertise in glass making, and it often brings that expertise to the markets it serves. At its plant in Nanjing, China, the company makes glass for lighting products. It also recently opened a plant in Zhengzhou, China, that makes television glass. The first line at the Zhengzhou plant, commissioned in December 2002, makes television glass funnels, also called cones. The second line, commissioned in February 2003, makes television screens. Once both lines are operating at full strength, the plant will have more than 300 employees working in four shifts.

At both its glass plants in China—and at other installations around the world—Philips relies on intensive batch mixers from Maschinenfabrik Gustav Eirich of Hardheim, Germany. The mixers use a rotating mixing pan coupled with one or more rotating mixing tools. There is also a stationary scraper on the vessel wall near the bottom of the mixing pan.

The reason for the company's reliance on the mixer is simple, said Fons Rikken, a powder technologist and project leader at Philips Lighting. "It provides a higher level of batch homogeneity in a shorter batch cycle than similar mixers, and there is less maintenance. A service life of more than 20 years is quite normal."



A diagram of the intensive mixer in action. It couples a rotating mixing pan with one or more rotating mixing tools. A stationary scraper is located near the bottom of the mixing pan.

He speaks from experience. Since 1974, Rikken has worked at the raw materials handling unit in Philips' glass manufacturing operations. Five years ago, the scope of his work widened to include powder handling in general for the company. He also provides outside technical support to companies not in competition with Philips. "My job is the coordination, design, construction, and realization of batch plants or single process operations for powders and/or cullet plants worldwide," he said.

"Sandwich" batching

Before mixing, however, comes the important step of weighing and batching the raw ingredients. "There is no difference between glass batch manufacturing for television products or for lamp products," Rikken said. "But we do distinguish large ingredients, such as sand and cullet, from intermediate, or transit, ingredients."

Cullet refers to surplus glass that is recycled to the process. Transit ingredients include soda, potash, and minerals such as dolomite and feldspar. They also include minor ingredients, such as the refining agents sodium sulfate, sodium antimonate, and sodium nitrate. Finally, there are micro-ingredients that constitute less than 500 grams of each batch but give special physical properties to the glass.

The weighed ingredients then flow to the mixer, where a moisturizing agent is added. Moistening the batch prevents the ingredients from segregating and reduces dusting. There is no need for specially placed nozzles within the mixer. "We just drop in a defined amount of water or oil, and the intensive stirrer takes care of it for optimal distribution," Rikken said.

Cullet, an abrasive material, takes a different path. "For cullet applications, the mixing process is skipped," Rikken said. Instead, Philips uses the "sandwich" method to add cullet to the batch. "The cullet is added as a layer in a fixed ratio on top of the batch layer of the sand and the chemical ingredients. It is then transported from the mixer to the glass furnace." In this way, all the ingredients, including minor and micro-ingredients, completely exit the mixer as a homogenous mixture. Furthermore, the cullet does not needlessly wear the mixer.

The fast mixers provide "a higher level of batch homogeneity," says the project manager.

This photo was taken immediately after the installation of two Type R 24 intensive mixers at a Philips glass-making plant in China. Philips began manufacturing in China in 1984, and the company is now firmly established in the electronics market there.

The mixing operation

The batching method is important, but the right mixer is crucial. "Our preferred type is an intensive mixer, because of its wide range in handling the number and amounts of ingredients," Rikken said. "For instance, there may be 50 percent of a major ingredient like sand and 0.005 percent of a micro-ingredient in one single batch." High mixing intensity eliminates the need for pre-mixing. "Going back in history, say 20 years ago, yes, we had to pre-mix," Rikken said. "Since the introduction of the intensive mixer, there is no need for a pre-mix operation."

To ensure that the batches comply with specifications, Philips conducts periodic tests. In the tests, workers fill the mixer with ingredients and the moisturizing agent. They then operate the mixer for a total of 3 minutes, stopping the machine every 30 seconds or 1 minute to take 15-gram samples at five different positions in the mixer.

"We measure the quantity of the specific glass elements that are present in the mixture, Rikken said. "The standard deviation divided by the average number—the so-called variation coefficient percentage—gives us an indication of the mixture's homogeneity. For our glass manufacturing purposes, the variation coefficient is less than 10 percent, and that appears to be an acceptable level. With the Eirich intensive mixers, we reach a variation coefficient of less than 5 percent within 3 minutes."

Rikken also described how the mixer operates in actual production. "We run a dry mixing time of less than 30 seconds. After adding the moisturizing agent, we run a wet mixing time of less than 3 minutes. Mixer discharge takes less than 30 seconds. Our overall batch cycle time lays between 8 and 12 minutes." he said. Mixing time is shorter if the batch house operates in "batch tracking mode." This means that the first step—weighing and batching—overlaps the second step of mixing. "The overall batch cycle time can be less than 8 minutes," Rikken said. "By measuring the batch homogeneity in increments of 30 seconds, we optimize the required mixing time."

Intensive mixers only

In recent years, Rikken and his colleagues have favored the supplier's Type R mixers over its Type D mixers. Both use the same mixing principle, but the Type D has a horizontal mixing pan, while the Type R has an inclined mixing pan. The incline increases the vertical force of the material current within the mixer.

An intense mixing action eliminates the need for pre-mixing.

The two mixers at the Zhengzhou plant are Type R 24 models and have a capacity of 2,250 liters. The Nanjing plant, which makes lighting glass, uses a Type DE 14, but Rikken plans to use a Type R 15 model (500-liter capacity) when Philips installs a second production line there in 2004.

"The Eirich Type R mixer shows even a better performance then the Type D," Rikken said. He noted, however, that the greater height of the Type R can make it more difficult to connect the outlet of the dosing and weighing system to the inlet of the mixer. Regardless, the better performance was too appealing to ignore. "We hesitated for quite some time in deciding to transfer from a Type D mixer to the Type R mixer," Rikken said. "But now we have modified our weighing systems and our extraction and transport systems to implement the Type R in an optimal way. Now, mixer selection for the purpose of glass batching is not really an issue for us."

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