

A visit to GlaxoSmithKline's Coleford site, near Gloucester in the UK, involves a few striking contrasts. Not the least of these is the way that a factory first occupied 60 years ago houses some of the most modern and sophisticated filling equipment in the world.

There are eight bottle-filling lines, five carton-filling lines and one line for Guala laminate pouches on the site. Many of the products, including Ribena and Lucozade, are non-carbonated. But carbonated variants such as Lucozade Energy are also filled there.

Unit volumes in PET bottles go from 33cl and 38cl up to 1.25 litres for the ready-to-drink (RTD) products. Ribena squash concentrate is also filled at Coleford, this time in bottle sizes of between 60cl and 2 litres.

GlaxoSmithKline (GSK) is particularly proud (and rightly so) of its three cold aseptic filling lines on the Coleford site. The most recently installed of these is a Kronos PET-Asept line, put in just two years ago, and typically used to fill the various Ribena fruit juice drinks into PET bottles. Project manager Gene Brown explains: "Since we have eliminated preservatives from our fruit-based products, we have had to move to aseptic filling in order to maintain shelf life."

The Kronos line uses a hydrogen peroxide-based wet sterilisation system. Normal line speeds are up to around 36,000 bph on Ribena variants in 50cl bottles, but when running Lucozade Sport (as overspill from other lines) speeds are reduced to around 30,000 bph. This speed, says Brown, is dictated by the technology used to sterilise the sports closures. He points up some metal stairs: "There are only three examples of the equipment up there in the entire world." That is as close as visitors get to the mystery system.

The first two aseptic lines acquired by GSK were sourced from Serac. Keith Marriage, packaging development director for the Nutritional Healthcare division, says: "The second Serac line achieves the same speeds as the Kronos equipment, the original being a smaller half-speed version. Serac was the first technology we used, and was hugely important in the way it allowed us into new areas for the first time."

Both Serac systems use laminar-flow clean room technology in contrast to the isolators that enclose the Kronos filler and capper. Both offer the highest levels of sterility, perhaps more than is necessary for low-acid products but indicative of GSK's pharmaceutical company culture.

The pressure is on the bottles

Liquid nitrogen plays a key role at GlaxoSmithKline's UK soft drinks filling operation. Paul Gander takes a look at how Vacuum Barrier is enhancing the multinational's move to juice packing in lighter bottles



► Control panel of the Kronos PET-Asept filling line which is being used for both Ribena and Lucozade Sport

ASEPTIC FILLING

Brown explained the differences. Serac's sterilisation fills each 50cl bottle with water, then with the same volume of peracetic acid solution, and finally with more rinsing water. "Krones uses a very small amount of hydrogen peroxide followed by a blast of water and sterile air," says Brown.

When Lucozade Sport is running on the Krones line, aseptic conditions are maintained, even though the current product formulation does not require them. Brown explains: "We did look at this intensely. We decided that we needed consistency in the way the line was treated by operators, as well as in internal conditions. We were also advised that, if line conditions were reduced from aseptic to ultra-clean, we would need to revalidate everything – and that would have taken far too long." An additional benefit is that, should the decision ever be taken to reformulate Sport without preservatives, the product already has a track record under aseptic conditions, he says.

Peripheral equipment on the Krones line includes a Fuji Seal Intersleeve sleeving system, an SMI shrinkwrapper able to produce padless shrink collations for transit and an SMI board multipack machine, able to produce four- and six-packs of Lucozade and Ribena. Within the same packing area, wrapped product is palletised using a Krones Pressant.

One key piece of equipment on the filling line itself is the self-cleaning, aseptic-grade Nitrodose liquid nitrogen-dosing system manufactured in the US by Vacuum Barrier and supplied by its agent in Belgium. The same system is used on the Serac lines, with liquid nitrogen used to build up positive pressure inside non-carbonated beverage bottles (see sidebar). As Brown puts it: "Just as in the brewing industry, we expel the oxygen from the headspace and top it off with nitrogen for internal pressure and extended shelf life."

Specified line speed on the Krones aseptic filler is 36,000bph, and the Nitrodose system is capable of matching this output.

Vacuum Barrier's nitrogen dosing technology (this time a Nitrodose HSV, high-speed valve) is also used on an ultra-clean line in another part of the factory, exclusively filling 50cl bottles of Lucozade Sport. Bottling Line



Project engineer Ian Davis with Vacuum Barrier's Guy Charbonnier. The need for nitrogen dosing was recognised when a new bottle without stiffening ribs called for better rigidity



3 runs at speeds of up to 42,000 bph. While the line itself was installed in 2000, the Nitrodose unit was added in 2005. Keith Marriage explains: "This enabled us to use a more modern bottle design with a flip-cap and valve, requiring the bottle to be firm in distribution (hence the liquid nitrogen), but squeezable for the consumer."

Here, neck-handling is used from the bottle infeed onwards. The Sidel

(formerly SIG) Simonazzi filler is in-line with a two-stage Blockrinser rinsing unit, after which bottles are inverted before entering the rotary filler. On exiting the filler, bottles automatically have their level checked with a Heuft Spectrum TX system.

As Marriage emphasises, all of the Coleford filling lines have their strengths. "So, for instance, the SIG-Sidel line has run really well, with capping performance being particular-





Lighter weight PET bottles for non-carbonated or lightly carbonated drinks such as Lucozade sport and Ribena require nitrogen pressurisation

Why lighter bottles need nitrogen dosing

The two most common uses of nitrogen dosing are pressurisation and inerting. Both types of application depend on the behaviour of cold, liquid nitrogen at room temperature, expanding and expelling air from the bottle headspace prior to capping. Often, though, the two functions are not distinct.

So while inerting, as the name suggests, aims to prevent product interacting with oxygen in the headspace as a form of modified atmosphere packaging, it may also have an additional pressurisation role.

In the case of GlaxoSmithKline (GSK)'s Ribena and Lucozade Sport products, the opposite is the case. Pressurisation is the principal requirement, but the nitrogen also helps to extend shelf life, says director for packaging development at GSK's Nutritional Healthcare division Keith Marriage.

Dosing equipment supplier Vacuum Barrier markets a range of liquid nitrogen transfer technologies. Belgium-based managing director Guy Charbonnier explains: "In-line dosing systems account for a growing proportion of the company's turnover, and they still have plenty of potential for further growth. Currently, inerting applications are becoming more common. But it is also true that a lot of companies haven't yet appreciated the savings that can be made by combining materials reduction with nitrogen pressurisation."

System accuracy is said to be better than 5 percent. On an 80m bottles-a-year operation, says the company, a cost saving as small as 1 percent per bottle will pay for the equipment.

Today, speeds on Vacuum Barrier's Nitrodose HSV systems reach 72,000 bph and more than 100,000 cph. Aseptic Nitrodose HSA systems are currently equipped with the same high-speed valves, says Charbonnier. As well as precise timing, the dosing apparatus can deliver equally precise volumes of liquid nitrogen with each drop, ensuring consistency in the resulting headspace pressure.

Charbonnier adds: "Generally speaking, all models have the capability of switching automatically to continuous flow mode at a set speed. For instance, high-speed canning lines will tend to be operated in continuous-

ly strong," he says. "Having a variety of machines and suppliers on the same site makes it easier to compare performance on particular functions such as capping."

The need for nitrogen dosing was first recognised, says project engineer Ian Davies, when the new bottle was designed without ribs and needed a clever solution to provide rigidity, strength, and avoid panelling.

Marriage explains the evolution of the PET packaging: "Originally, the 50cl bottle

ASEPTIC FILLING



Vacuum Barrier's Nitrodose application system offers a dosing precision of five percent. Cost savings as small as one percent on an 80m bottles-a-year line will pay for the equipment, it is claimed

flow mode since, unlike with bottles, very little liquid nitrogen is wasted between cans."

The combination of new age drinks with lightweight packaging often provides a minefield for marketers. Richard Horwell, managing director of International Branding, knows all about the benefits of nitrogen dosing technology for cans. A Middle east-based contract packaging firm (no longer contracted) attempted to fill his low-carbonated Energy 69 drink into aluminium cans without it and found them being dented. "If you are using aluminium rather than steel on a still beverage, you need that pressurisation," he says. "It is particularly important given the increasing emphasis on vending. Without nitrogen dosing, you can't vend."

• Vacuum Barrier has for more than 30 years been the exclusive distributor in Europe, the Middle East and Africa of cryogenic equipment manufactured by US based Vacuum Barrier Corporation which this year celebrates its 50th anniversary.

More information from Vacuum Barrier, Boulevard de la Cense 72, Waterloo, B-1410, Belgium. Tel: 322354 7177. Fax: 322354 7222.

weight for Sport and Ribena was 30g. The new bottles, introduced in summer 2006 were designed for a 30/25mm neck, and modelling showed that 26g was a safe weight to get the necessary shelf life for our range of products.

"Over the last year or so, the liquid nitrogen, allied with a new base design developed by Amcor and Sidel, has enabled a further 3g to be removed from the bottle without any risk of base roll-out."

According to Marriage, the bottles are stan- ▶

ASEPTIC FILLING



The packaging hall at GlaxoSmithKline's plant includes sleeving equipment from Fuji Seal and shrink wrappers from SMI

standard PET. "The nitrogen does permeate through the plastic," he explains. "However, as it is very insoluble, this action is limited to the headspace where there is less bottle surface to penetrate, and consequently loss is slow. Nitrogen is also less temperature-dependent than carbon dioxide, for example."

In carbonated beverages such as Lucozade Energy, it is the carbon dioxide which provides pressure for the same type of lightweight container, and also serves to flush oxygen out of the headspace for longer shelf life.

Meanwhile, GSK is addressing new materials challenges with the announcement last autumn that it is moving its Ribena brand into 100 percent recycled PET (rPET). The ready-to-drink products have already been switched from 40 percent rPET, and the company hopes to move the squash range the same way over the next few months. Both demand and supply of rPET is on the rise in the UK, with annual production of 30,000 tonnes of premium and food-grade recyclate forecast for July 2008.

Resource reduction and increased demand for fresh fruit juices are the drivers for lighter weight plastics bottles and low- or non-carbonated products. But pack integrity must be maintained. Liquid nitrogen dosing's future looks assured. **TFB**

GSK and Coleford

GlaxoSmithKline (GSK) is a £23.2bn (US\$45.4bn)-turnover company with 100,000 employees in 117 countries. In 2006, the pharmaceutical business was responsible for more than £20bn (\$39.1bn) of group turnover. Highest earners were the Seretide and Advair group of drugs for asthma and lung conditions, worth £3.3bn (\$6.46bn), and vaccines, with a value of £1.7bn (\$3.3bn).

Lucozade and Ribena are both among the top five Consumer Healthcare products, with respective sales volumes of £301m (\$589m) and £169m (\$331m).

Ribena juice drink began life in World War Two, when the German blockade put a stop to citrus fruit imports. Bristol-based HW Carter & Co stepped up production of its blackcurrant cordial after the government encouraged domestic cultivation of the fruit.

Immediately after the War, following the loss of coal and iron-based industries in the area, the local development association incentivised industries to relocate to the Forest of Dean. In 1947, Carter & Co chose Coleford for the site of its new factory.

In 1955, Beecham Foods acquired Carter & Co, and soon afterwards began production of Lucozade alongside Ribena. In 1990, Beecham became SmithKline Beecham, and in 2000 merged with Glaxo Wellcome to form GSK.

Some 1bn bottles of Lucozade and Ribena are filled a year. According to GSK, around 95 percent of its containers originate from the Coleford site. Some glass is filled at Northern Beverages, cans at Cott and one-litre Tetra cartons at Princes.

