

# Blending & Dosing at the Freiberg Brewery

## In-line blending plant for beer mix drinks commissioned

by Hendrik Matthes and Andreas Schiessl

The market for beer mix drinks has shown constant growth over recent years. Almost all the larger breweries offer beer mix drinks among their products, among them the Freiburger Brauhaus in Freiberg, Saxony. This brewery, a member of the Radeberger Group, has been successfully supplying the market in Saxony/Germany for many years. Beer mix beverages are coming to represent an ever growing proportion of its output; at present, the brewery produces shandy and a cola/beer mix.

In the late summer of 2007, the Freiburger Brauhaus took the decision to upgrade its beer mix beverage production to the same high technical level that is to be found in all other departments of the brewery.

In order to facilitate flexible production and bottling schedules, while at the same time avoiding having an unnecessarily large proportion of the existing storage capacity occupied by beer mix beverages, the planning team in Freiberg decided to use continuous blending in the production of the beer mixes. The company GEA Diessel GmbH was first shortlisted as a well-known and competent vendor of continuous blending technology, and ultimately,

thanks to a convincing technical solution, a very good cost-benefit ratio and a promise of delivery within an acceptable period, won the contract to supply its DICON-C™ continuous in-line blending system.

### Technical specifications

During the very first meeting with the Freiburger Brewery's planning team to discuss technical aspects, the following features were identified as being essential:

- Continuous in-line blending without a separate buffer tank directly upstream of the flash pasteurization unit, the buffer tank of that unit also serving as a buffer for the blending unit.
- Throughput of the device to be continuously adjustable to match that of the filler and the flash pasteurization unit, so that the blending unit is affected as little as possible by the almost unavoidable stop-and-go operation of a filling unit. This is to ensure that blending is performed with the highest possible degree of precision.
- A compact design with integrated container positions for the ingredients, extendable for possible additional ingredients should the range of products be extended.

- Operational control through a graphical control panel directly at the blending unit, but also from the superordinated control system.
- Integration into the existing filtration cellar CiP system without any modifications to the CiP program, but ensuring that the hygienic standards required in the Freiberg Brewery are maintained.

### Construction of the system

The system was built very compactly, with optimum adaptation to the space available (Figure 1). It was completely preassembled at the manufacturer's facility in Hildesheim, and their customary testing procedure was carried out, using water.

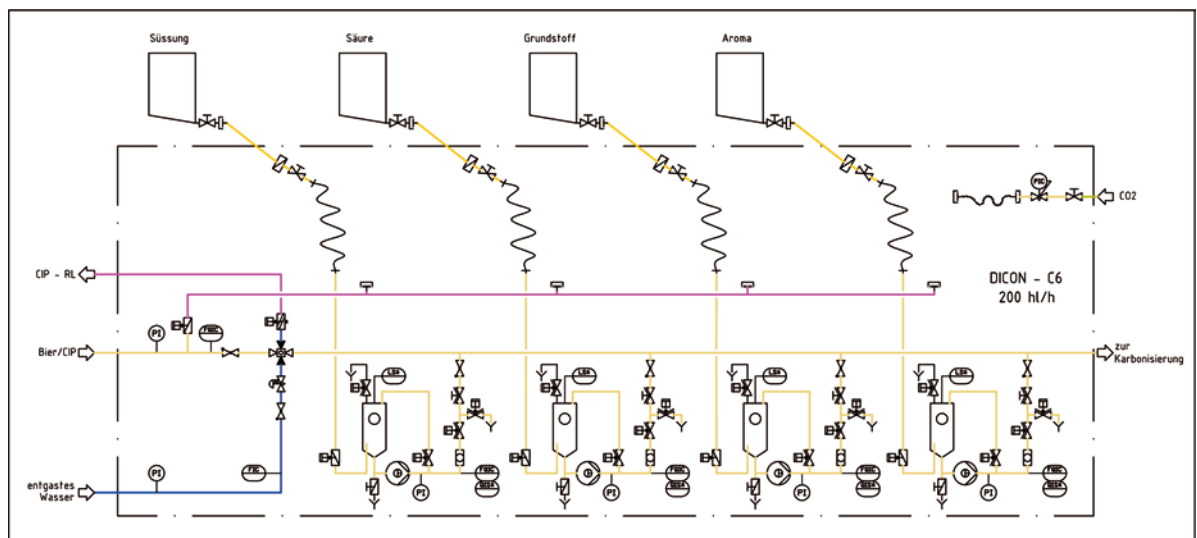
After the installation of the device at the customer's facility, the piping systems were connected and the electrical and automation connections installed jointly with local firms.

### Technological features

Throughput of the blending device:

- 250 hl of finished carbonated beverage per hour through the blending of the ingredients directly in the product pipe

Diagrammatic representation of the blending unit. Photos and diagrams: GEA Diessel GmbH



Number of dosing lines: 8

- Beer
- Deaerated refrigerated brewing liquor from the buffer tank
- Cola base from an IBC
- Fruit acid from an IBC
- Flavoring from a permanently installed storage vessel
- Ascorbic acid from a permanently installed storage vessel
- Sweetening from a swap tank
- CO<sub>2</sub> in the DICAR-B™ carbonating unit

Technical features:

- A very high degree of blending precision thanks to accurate flow metering technology
- Digital regulation, so that no deviations from recipe can persist
- Monitoring of the concentrates by density measurement; this practically eliminates the possibility of faulty production resulting from confusion between the containers
- An integrated framework above the blending unit to hold the containers
- CO<sub>2</sub> fed into the containers to agitate the concentrates and to expel

concentrates from the device back into the containers after the end of production

## Components of the system

- Permanently installed component tanks for the preparatory dissolution of dry ingredients (Figure 2)
- Positions for the swap tanks from which the concentrates flow to the individual dosage lines (Figure 3)
- CO<sub>2</sub> dosage; injector and regulating valve (Figure 4)

The concentrates flow by gravity to the dosing pumps. Mass flow meters are installed in the concentrate lines, giving precise metering values; simultaneously, the density of the concentrate is determined and compared with the reference densities held in the recipe memory. Blending takes place in-line in accordance with the recipes stored in the control unit. In addition to the pure volumetric composition of the finished product, quality parameters are also held in the control unit, namely:

- specific gravity in °Plato
- conductivity measurement in mS/cm<sup>2</sup>
- CO<sub>2</sub> content in g/l

Any deviations in either direction from the freely selectable limit values for the individual components are very quickly identified and corrected (Figures 5, 6).

## Commissioning of the in-line blending system

Two technicians from the manufacturer carried out the mechanical and electronic installation work. The unit was commissioned quickly and efficiently, with great interest and involvement on the part of the Freiberg Brewery. Measures which are necessary in such a complex process, such as

- the integration of the plant control unit into the operational data recording system
- mechanical adjustment and “tuning” to harmonise with downstream equipment (the flash pasteurizing unit)



**Figure 1: Beer blending unit with four container positions and two permanently installed dissolving and storage vessels**



**Figure 2: Permanently installed component tanks for the pre-dissolution of dry ingredients**



**Figure 3: Positions for the swap tanks with the gravity lines supplying the concentrates to the individual dosage lines**



**Figure 4: CO<sub>2</sub> dosage; injector and regulating valve**



**Figure 5: A view of the analyser line**



**Figure 6: Control cabinet with graphical operating panel**

- the pre-treatment of dry ingredients and the attainment of the optimum temperature for their dissolution were implemented jointly with the Freiberg Brewery's project team.

## Regulation of the system

The essential components of the plant control system are the digital flow regulators and the calculation module for the target throughput values. On the basis of the recipe held in the control unit, this calculation module calculates what proportions of the total throughput each individual component throughput represents. This calculation takes place continuously.

If it should occur during production that the throughput of the main stream or of any additional ingredient cannot be maintained at the desired level, the throughputs of all ingredients are recalculated immediately. This ensures 100 per cent that the individual ingredients continue to make up the correct proportions of the finished product, even though the blending plant is not working at its full capacity. To regulate the individual flows, special "self-learning" digital software regulators are used. These are able to identify, integrate and compensate for shifts in the relative dosages of the individual components. These regulators are also distinguished by their extremely rapid adaptation after the start of production, through which any deviation in regulation at start-up can be corrected within a few seconds.

One particular feature of the flow regulators is their reactivity to changes in target throughput settings. Unlike traditional regulators, they do not approach the new set values step by step, but calculate them by comparing the set value with the current actual throughput. They react immediately to changes in flow, without overcompensation.

## Operational experience

Once the exchangeable concentrate containers have been put in their proper positions by lifting gear or a forklift truck and the permanently installed storage

vessels have been filled, beer and water are admitted to the unit. The release for production is given after product has been called for by the ABB control unit of the process control system. The signal to start production comes either directly from the superordinated control system or by pressing a button on the graphical operating panel of the plant control unit. This is not possible unless all the start conditions of the bottling unit, the flash pasteurisation unit control system and the product paths have been fulfilled, having been polled by the control unit and the control system of the blending unit.

Ingredients are added to the blend of beer and deaerated water by volume. Any fluctuations in the throughput of the main stream are compensated for within a very short time by the frequency-regulated positive rotary piston pumps.

All production data such as:

- current actual throughput
- individual quantities
- total quantity
- concentrate consumption
- specific gravity of the finished product
- CO<sub>2</sub> content of the finished product
- pressure at the plant outlet

## Looking at the Whole

often provides the best solutions. Innovations cannot be squeezed into an ordinary category of machine technology. Therefore, **enviro** ranges over three dimensions: ecology, economy, and ergonomics. **enviro** stands for intelligent technology which is environmentally friendly, cost-saving, and efficient. This way, we assume responsibility for our world and the people who live in it.



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	Standard deviation			
	Wort	CO <sub>2</sub>	Color	pH
Cola-Beer	0,04	0,05	0,36	0,01
Shandy	0,07	0,10	0,08	0,01

**Table 1: Scatter of the relevant analysis values**

is constantly available and is communicated to the operational data management system. Where throughput fluctuates as a result of the stopping and starting of the bottling unit, the output of the unit is regulated in accordance with the filling level of the flash pasteurisation unit buffer vessel.

After the end of production, the concentrates are expelled from the unit back into the containers. This is done with CO<sub>2</sub>; the operators simply attach one or two tubes.

When the plant has been emptied under pressure, the CiP program is started. All parts of the plant are thoroughly cleaned. Cleaning is performed with hot caustic solution and acid, since the beer mix beverages are always the last batch to be racked before the weekend. The DICON-C™ blending unit is then ready for further production.

As the oxygen content of the blended product proved to be very low, with the O<sub>2</sub> values in the bottled beer remaining constant and there being no modifications to the racking technology, it was decided after a series of "tastings for ageing" to dispense with the addition of ascorbic acid.

In respect of ingredients supplied by Symrise of Nördlingen and Aspera Brauerei Riese of Mülheim an der Ruhr for use in the manufacture of beer mix beverages, the fluctuations set out in Table 1 were measured in the bottled finished product. All the guaranteed values demanded in the contract were easily complied with right from the start.

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