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## Expert Report

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### Large shell boilers for paper production

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The production of paper was described for the first time in the year 105 AD by a Chinese Minister for Paper. Since the development of efficient boiler systems around the year 1800, the steam boiler has been inseparably connected with paper production. At first as part of the steam engines that powered the paper-making machines, and later on for processing, drying and 'steam-ironing' the paper. The paper industry has been growing for years at a dramatic rate. Changed consumer behaviour, increased environmental awareness and aggressive competition are increasing the variety and quantity of the paper products available. This in turn requires faster technological advancement and larger manufacturing machines. The requirements for suitable steam boiler systems have grown at a rate to keep pace with the growth of the paper industry.

#### **Expertise and trust**

Bosch Industriekessel is a worldwide renowned specialist for boiler systems of all sizes and outputs. Since our founding in 1865, we have specialized in industrial boiler construction and we have acquired an extensive and special know-how. Strength in innovation, quality awareness and efficiency have become the benchmarks of our product range and services. More than 115 000 boiler systems supplied to over 140 countries are clear

proof of the high quality and reliability of our industrial boilers. Our equipment can be found in practically every sector of industry – among them the food and drinks industries, the building and chemical sectors, as well as the textile and paper industries. Global players such as Coca Cola, BASF, Siemens, Ytong, Heineken, Nestle and Esso have just as much confidence in our innovative steam and hot water boiler systems as do our local customers.



Figure: Four Double-Flue Boilers UNIVERSAL ZFR with superheater module

Latest generation paper making machines are designed for paper webs of up to 10 metres in width in combination with speeds of up to 2 000 metres per minute and they are only able to demonstrate their best performance with suitable boiler systems. Even for these most modern and very large paper production machines Bosch Industriekessel has suitable boiler systems with proven firing systems and controls. Using the standard well proven designs at standard design pressures, the user can have complete confidence in the safety and performance of the boiler systems. Correctly dimensioned and control-switched, the UNIVERSAL series boiler fulfils all the demands.

#### Highest availability for 100 % supply continuity

An example of this:

With four equal sized steam boilers, in each case 30 000 kg/h efficiency ( $4 \times 30\,000 = 120\,000$  kg/h) for two paper-making machines with a power demand of over 40 000 kg/h ( $2 \times 40\,000 = 80\,000$  kg/h) and an additional basic load requirement of 10 000 kg/h, this means that a paper manufacturing plant is very well equipped. Although during normal operation not more than 90 000 kg/h are needed, all four boilers operate with the same load (75 %) and have good partial load efficiency factors. This means that one boiler can be taken out of use (e.g. for servicing) without any negative influence on the paper production.

For this size of output Bosch Industriekessel uses boilers of the UNIVERSAL ZFR series. They are designed in the proven three-pass principle with separate heating gas ways for unrestricted single flame tube operation and they are equipped with two

burners for independent individual operation if required. The advantages are clear. Compared with boilers which permit only one parallel operation of both burners, this boiler system has a double range of control. Even in the case of failure of two burners on different boilers, the supply is secured. Twin fire tube boilers, for unrestricted continuous operation when utilising only one flame tube if necessary, are eminently suited for this application. They ensure the highest security of supply for the continuous operation of paper production machines around the clock.

#### Each paper break is safely controlled

A paper break is a critical event. It requires the shutdown of the paper production machine, and the sudden interruption of the machine heating. A correctly placed sensor signals this incident and sets all burners to their lowest load levels. At this time the heat produced is stored in the water volume of the boilers and causes a definable increase in pressure, which is taken into account in the control systems. This means that cut-off of the boilers from overshooting the maximum allowed pressure can be reliably avoided. A load decrease of 40 000 kg of steam is comparatively harmless.

Even with a load decrease of 80 000 kg of steam, by the simultaneous shutdown of two paper production machines if we remain with this example, there is compensation from the adapted control system without the need to cut off the boilers. Also the smallest basic load is accomplished in each case by shutdown of one burner (one flame tube operation) of the individual boilers. The burners remaining in operation work with minimum load within the modulating area.

### Well prepared for the load step change

Burners with a large range of control and an intelligent control system for this operating condition form the best prerequisite for the load step change during starting. Within a few minutes 'full steam' is demanded from the boilers. On the other hand the rate of change is restricted by the heating performance, which is associated with the maximum stress and durability of the boilers. It is the know-how of the experienced boiler manufacturer that enables the use of the additional heat-storage capacity, and to multiply the boiler nominal load for a few minutes with intelligent control of the basic load consumers. Thus the peak demand for the starting load step change is controlled without failure.

The boiler system can be configured without an early warning system for the load step change. The spontaneous load change is carried out without stress for the boilers and without impairment of the steam quality. The steam supply is controlled fully automatically and reliable for each type of paper break. The technicians responsible for paper production can concentrate fully and completely on their paper production.

### The Boiler Control BCO has everything under control

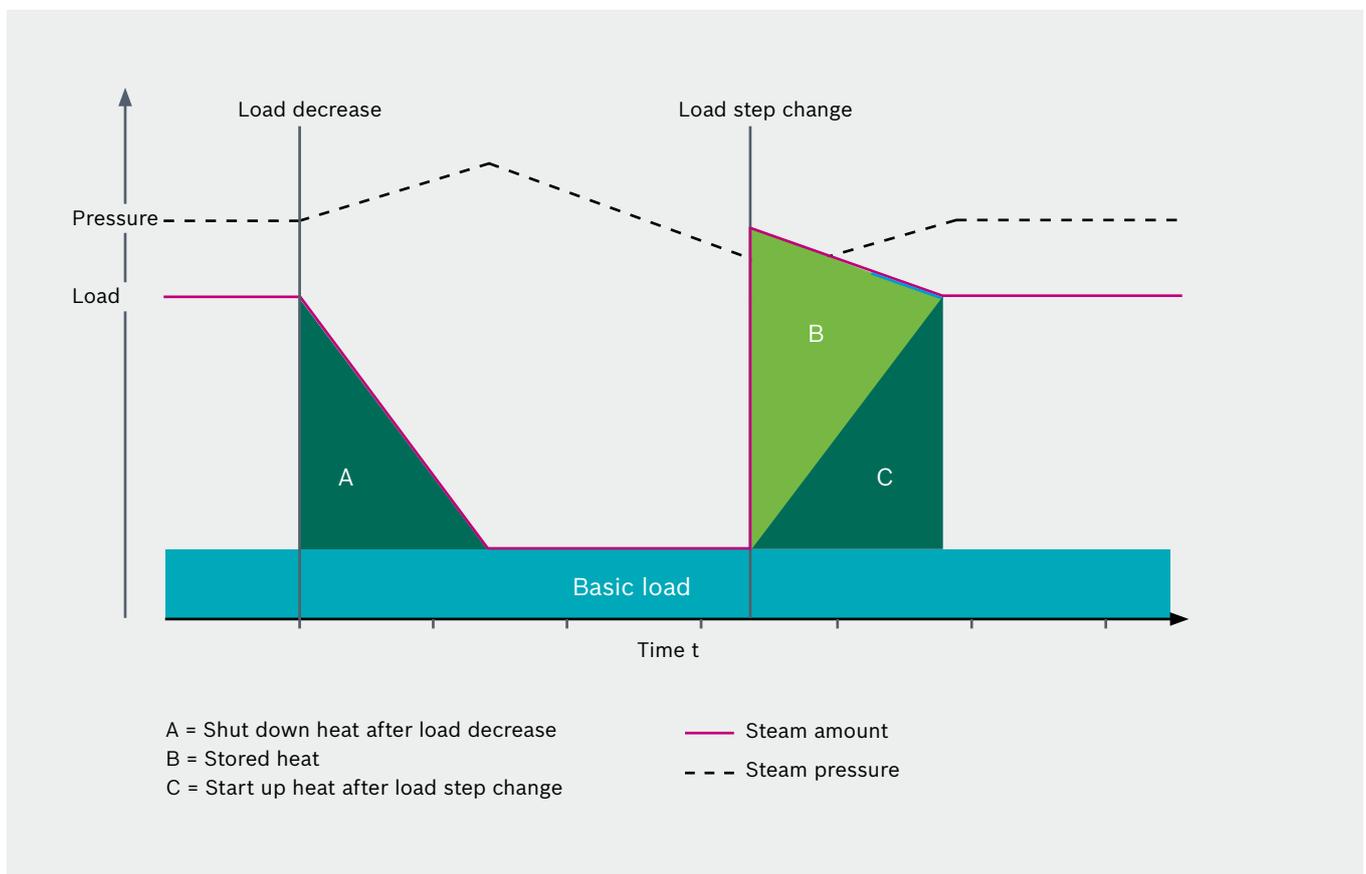
Each boiler is equipped with an efficient automation device, the 'BCO', which controls an integrated operating and breakdown warning system. Using an easy to read control menu with a plain text display for almost all languages, all the operation-related measured values and statuses are displayed. With the option for data exchange with overriding control systems, the technical requirements of paper production machines are completely fulfilled.

### Useful options improve the effectiveness

Boiler systems for the paper industry, built as proven three pass boilers with a single flame tube (type series UL-S) for capacities up to 28 000 kg/h and with two flame tubes (type series ZFR) up to 55 000 kg/h, can be equipped with modular economisers and/or superheaters when required. These additional features enable an efficiency of up to 95 % and a steam superheating up to 300 °C. For larger steam networks with longer piping distances, modest steam superheating is of advantage for the relief of the network drainage. Both superheater and economiser-modules are integrated into the boiler and insulated. Additional foundations are not necessary.

### Great practical experience from numerous successful projects

Bosch Industriekessel develops the optimum solution for each requirement. Whether it is a question of the renewal or the extension of the steam and heat supply system. We have the know-how from the experience gathered from decades of successfully operating boilers all over the world. The proven boiler systems in conjunction with most modern control systems meet the special requirements of the biggest and most modern paper and cardboard machines for the reliable and economic supply of steam and heat. CE marks and certification, which exceeds the requirements of most approval authorities worldwide, simplifies the acceptance of the boiler systems.



Graphic: Steam parameters at paper break – every paper break is quickly controlled

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