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Avoiding costly production downtimes

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How supply reliability can be implemented in process heat and how well-dimensioned multi-boiler systems can contribute.

The issue of necessary supply reliability always arises during the design stage in the context of process heat and heating energy supplies. Regardless of the situation, it can be reasonable, for example, in the housing industry, that heating and domestic hot water fail for a few hours in exceptional cases until a fault has been rectified. In return, it is possible to reduce investment and on-call service costs for tenants. In industrial production, however, disruptions in supply can cause enormous losses, for example, as a result of the high number of production workers who can no longer complete their tasks. In the worst case, this can result in the disposal of entire batches in the current production of foodstuffs or medicines. Imagine that chocolate in steam-heated pipes would harden and lose its quality after re-melting.

Basic options for influencing the statistical availability of heat supplies

Maintenance and digital support

The simplest and most obvious prevention lies in regular maintenance. This allows possible signs of wear to be identified early and for adjustments to be made, e. g. in the context of frequent burner cycles, stress caused by thermal variations or the formation of harmful residues. A further often underestimated factor is a well-trained boiler attendant. Incorrect operation and insufficiently trained operating staff, particularly in the fields of water chemistry and fault detection, are frequent causes of failures and damage to boiler systems.

Digital boiler log books

analyse the measured values and immediately detect deviations or critical states.

Digital boiler log books offer progress in this regard. Tendencies or critical deviations are often detected too late or not at all during stipulated water-chemical measurements and system checks. A digital boiler log book analyses the measured values entered and assists the user with individual information and suggested solutions.

Redundant components and spare parts storage

A common practise is to install certain critical system components redundantly from the outset – some components in boiler systems have no endless service life. Feed water pumps, for example, are often installed redundantly, as there can be long delivery times for special models.

Nowadays, the first boiler manufacturers are starting to offer 24/7 worldwide on-call availability. Nevertheless, storing spare parts on site is also common. This offers many advantages, particularly in the case of special components and in countries with long transport routes and lengthy customs procedures.

Predictive maintenance – taking action proactively

One attempt at a technical solution in the context of the introduction of Industry 4.0 concepts is so-called predictive maintenance. The probability of failure of important components can be identified using additional measuring equipment and intelligent evaluation. Smart algorithms interpret the data and identify deviations from operating parameters and their causes. In many cases, predictive maintenance makes it possible to order spare parts just in time. Modern predictive maintenance systems also offer a certain additional legal protection for the operator. The system can digitally document the completion of tasks in the context of their duty of care towards their employees.

There have also been some improvements in terms of fault detection and fault reporting in the last few years. While boiler attendants used to continuously operate and supervise the systems, today, modern boiler systems run in fully automatic operation without constant supervision – for up to 72 hours. Without boiler attendants on site, faults may only be identified the following morning. Due to this, it is sensible to forward the system's fault messages to the user via remote technology/central control system. The notification reaches those on shift or the 24/7 service representative on their mobile

Industry 4.0 in the process heat

Digital assistants evaluate operating data, ascertain the condition of components based on their operation and predict expected service life.

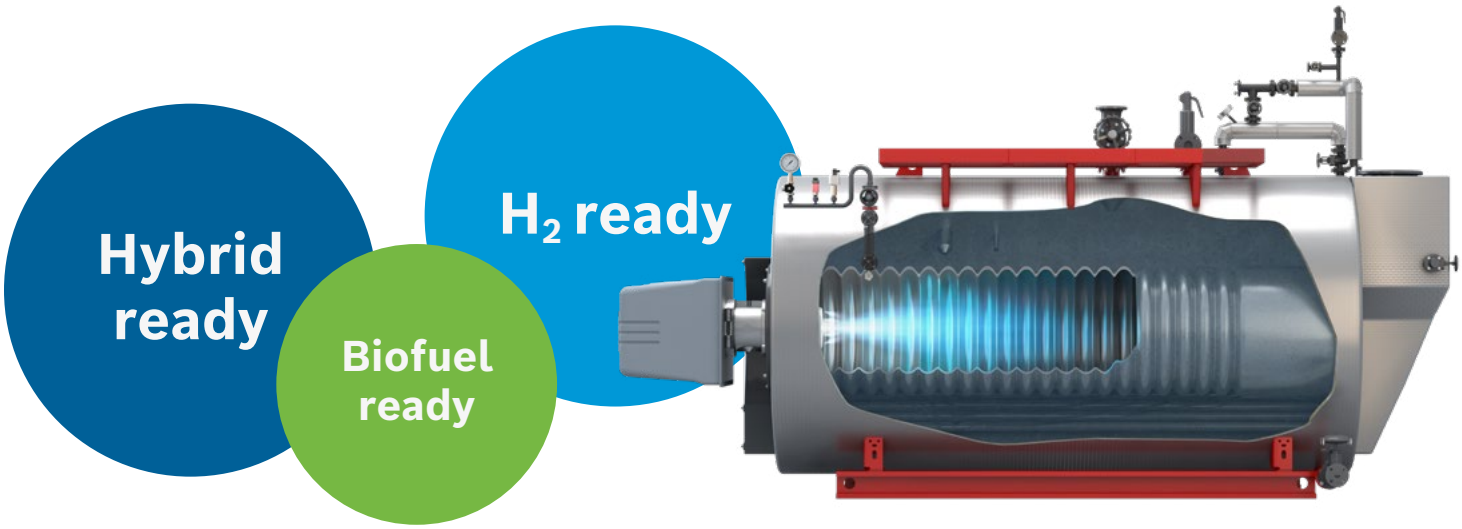
device. This results in an immediate reaction and fast detection and rectification of faults.

When the fuel supply fails – multi-fuel burners

But what use is state-of-the-art boiler technology if the fuel supply interrupts? Using multi-fuel firing units can help. Systems with local fuel storage tanks (e.g. oil) can fully automatically guarantee interruption-free operation during times of insufficient main fuel supply. The fuel type convertibility also offers advantages, particularly in terms of alternative fuels.

Many industrial boilers are already equipped to switch over to up to 100% hydrogen, bio fuels or green electricity at a later point. This ensures the long-term sustainability of the process heat supply.

But electricity is also directly required for the operation of a boiler system. For vital uses, such as in hospitals, boiler systems are therefore integrated into back-up power supplies, to avoid their failure in the event of a power cut.



Fully redundant boiler systems

Intelligent multi-boiler systems

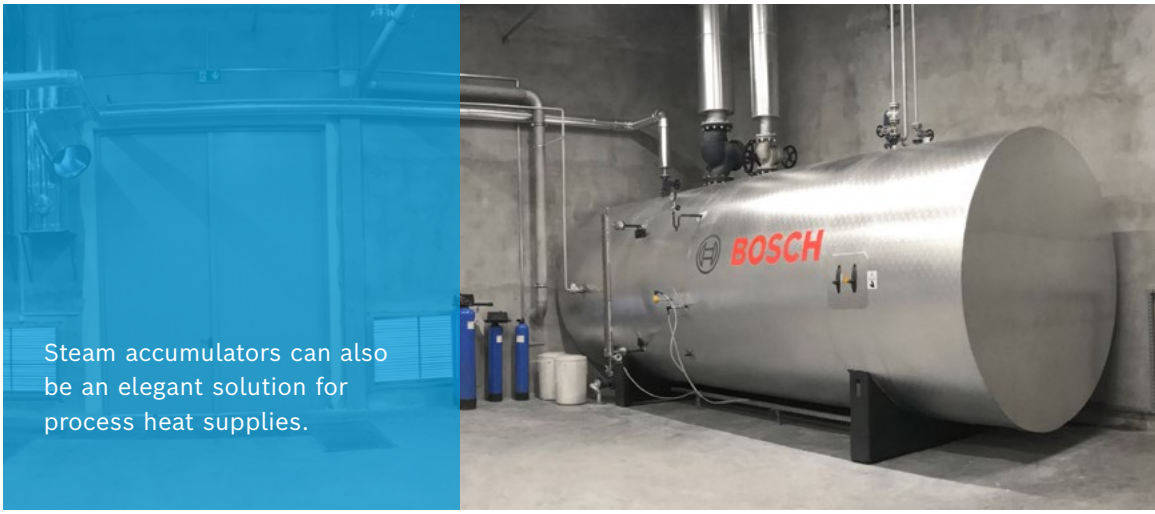
Full redundancy for a failed boiler, however, only offers a reserve boiler. In practice, it is common to find systems with two equally sized boilers. Ideally, an intelligent sequence control will ensure regular switching of the primary boiler depending on the operating hours. The slave boiler is turned on and off fully automatically through the individual operating profile. When using a sequence control circuit, heat maintenance is mandatory. If the steam demand in production increases, the slave boiler can be turned on immediately. Frequent burner cycles for heat maintenance and the associated high load on burner components should be avoided. Long downtimes without corrosion prevention are also disadvantageous, as this could damage the boiler.

Asymmetric boiler combinations

In many cases, a more cost-effective alternative to two equally sized boilers is possible, which may even reduce fuel consumption. Depending on the situation, combinations of bigger and smaller boilers can be used to cover all scenarios. For the perfect solution, load profile, the various individual loads, diversity factors and the prioritisation of consumers must be known. It is rare that all processes are system-critical and must take place simultaneously – in this case, two equally sized boilers would then be needed. In most cases, certain processes and consumers can be staggered in time. A typical example is simultaneous turning on of consumers at the beginning of a shift. Possible solutions include offsetting by a few minutes or pilot signals that announce a large consumer. This allows for an advanced start-up of the boiler and avoids pre-ventilation times of the burner during the actual demand situation. In daily operation, this can have advantages in terms of consumption; if the smaller of the boilers covers the actual load case (e.g. 0–25 % of the rated output), it can modulate with much more precision within this range. With an assumed control range of 1:7, the burner can modulate downwards to 3.6 % on the lowest load interval – in the case of two equally sized boilers, the smallest possible load would be twice as high. A significant advantage of the large modulation range is avoiding the so-called pre-ventilation losses. This is the consequence of every burner start, when cold fresh air flushes through the boiler's combustion chamber multiple times.

However, in practice, such asymmetrical boiler combinations are more common in multi-boiler systems with more than two boilers. Typical examples include highly seasonal production facilities such as breweries, due to their higher utilisation during the summer. Large heating systems are also a typical example – during the warmer months, only domestic

A sophisticated dimensioning of a multi-boiler system and intelligent sequence control are crucial for smooth and economical processes.



Steam accumulators can also be an elegant solution for process heat supplies.

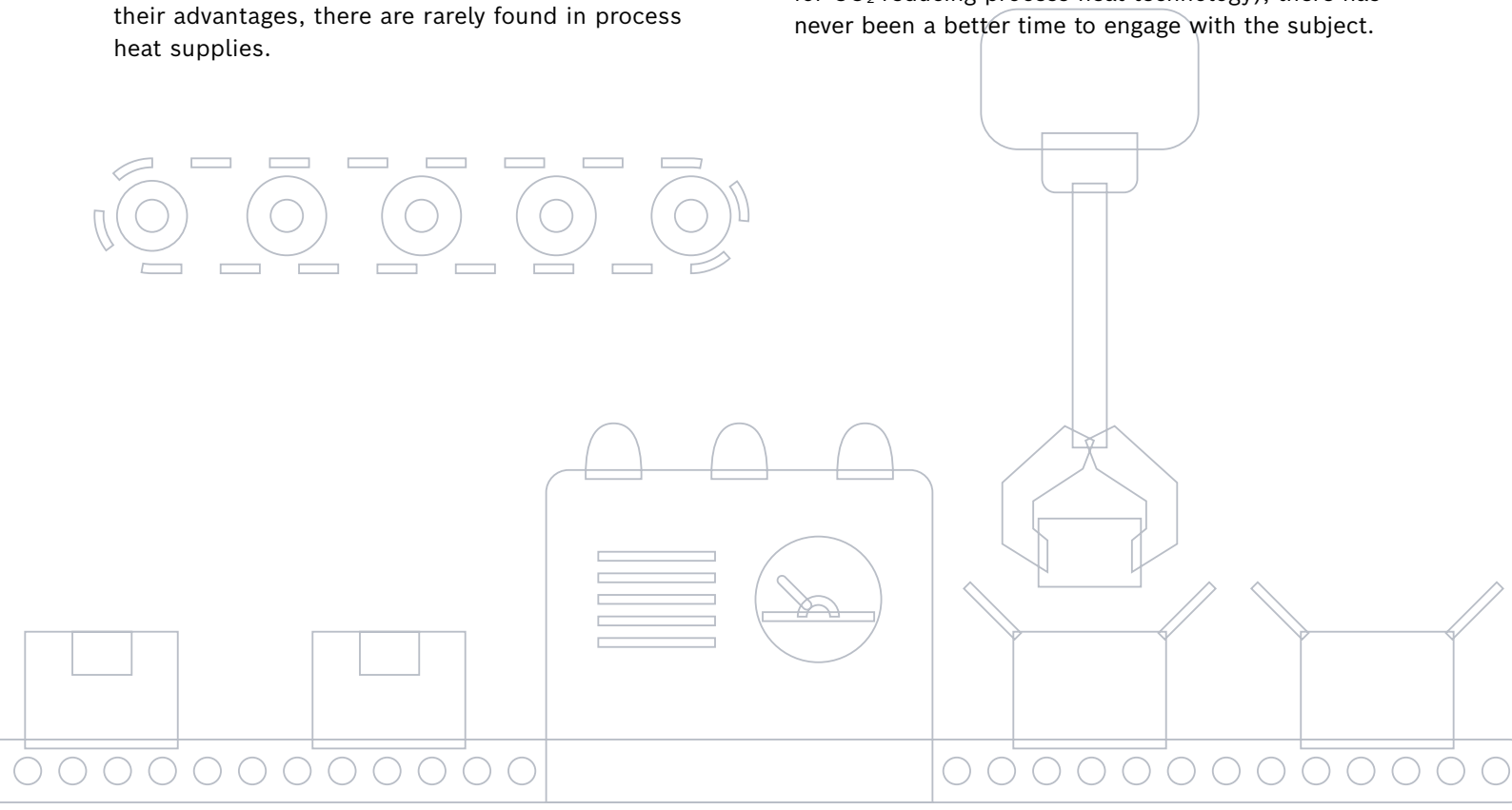
hot water heating is operated; this usually amounts to approximately 20–25 % of the heating capacity for the year. Systems with a 20/40/40 distribution (=100 % peak output) are therefore often used.

Steam accumulators for peak loads

The importance of accumulators, analogous to the use of capacitors in electrical engineering, should not be overlooked. With their help, load profiles can be decoupled from generators and consumers. If, for example, the required output exceeds the rated output of the boiler, the accumulator can assist temporarily. During a subsequent low-load phase, it will be refilled again. Accumulators are well-known and used in domestic hot water systems. Despite their advantages, there are rarely found in process heat supplies.

Summary

Modern boiler technology offers a variety of options to ensure customised and cost-optimised supply reliability. Even existing systems can be easily supplemented or modernised in response to changing requirements. In the context of today's optimised manufacturing and global competition, high costs resulting from unplanned production downtimes and for energy supplies play a crucial role for many companies. Inefficient and unreliable heating energy and process heat is an avoidable factor nowadays. Even in the light of today's environmental issues and the attractive subsidies currently offered (in Germany, for example, up to 40 % for CO_2-reducing process heat technology), there has never been a better time to engage with the subject.



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