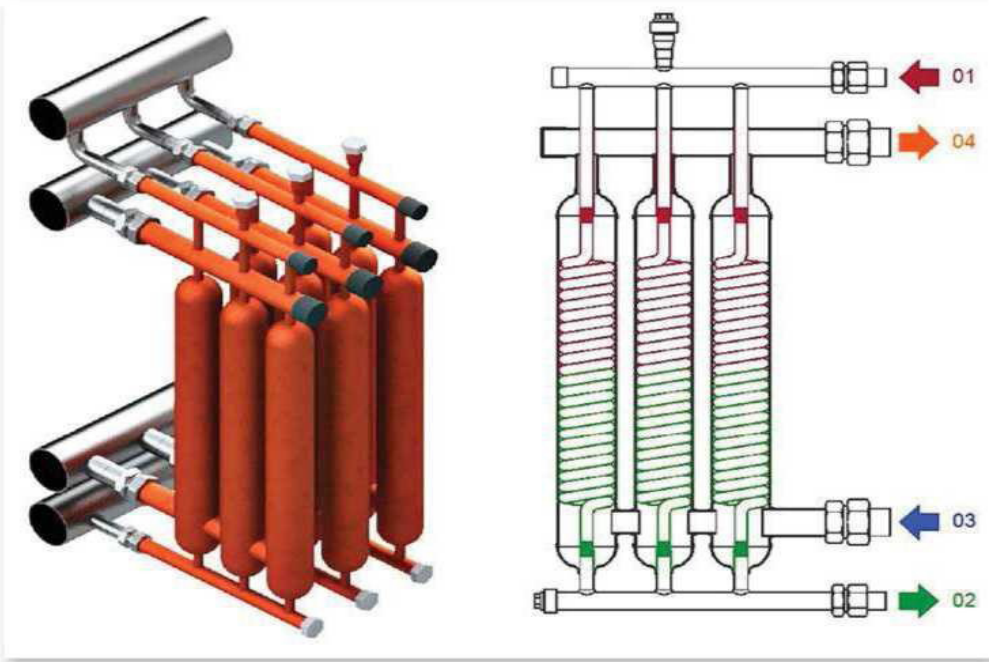
Reference project of W. Baelz & Sohn

Manifold System for Heat Transfer

For the production of corrugated cardboard, paper is brought into shape and glued at 180°C with steam. The cardboard manufacturer Kunert Wellpappe uses a manifold system to condensate part of the steam for heating the factory floor.



Picture: W. Baelz & Sohn

1 Modulo steam heat transfer station. The steam enters from the top (01) and exits at the bottom as condensate (02). The heating water is heated in a counter-flow, the return flow (03) is connected at the bottom and the supply flow (04) at the top.

Corrugated cardboard is an eco-friendly packaging material, because it consists mainly of natural raw materials. The Covid 19 epidemic and the resulting contact restrictions were an additional booster for on-line purchasing. This resulted in a huge demand for eco-friendly packaging materials such as boxes and cartons as well as special packaging, or even heavy-duty and hazardous goods packaging – all made of corrugated cardboard. For environmental reasons, plastic packaging is to be avoided to an increasing extent. Therefore, eco-friendly cardboard packaging has become indispensable for our modern way of living and purchasing.
Its main constituent is recycled waste paper, to which semi-chemical pulp made of waste wood and thinned timber is added. So the cartons can be used with a clear conscience – as many times as possible - and then recycled.

For the production of corrugated cardboard, steam with a temperature of 180°C is required.
The basic raw material for corrugated cardboard is unfinished paper, which is made in paper mills from the materials mentioned above and delivered to the production site in large rolls. Depending on the required strength, the corrugated cardboard has several layers.
One or more corrugated sheets are placed between the smooth inner and outer liners.
Corrugated sheets are produced by shaping the smooth base paper under pressure by means of corrugated rollers. Hereby, one or both corrugated rollers are heated. Shaping is supported by treatment with moisture (steam) and heat, whereby the corrugated sheet is passed over a rotating cylindrical pre-heating and humidifying device (conditioner).

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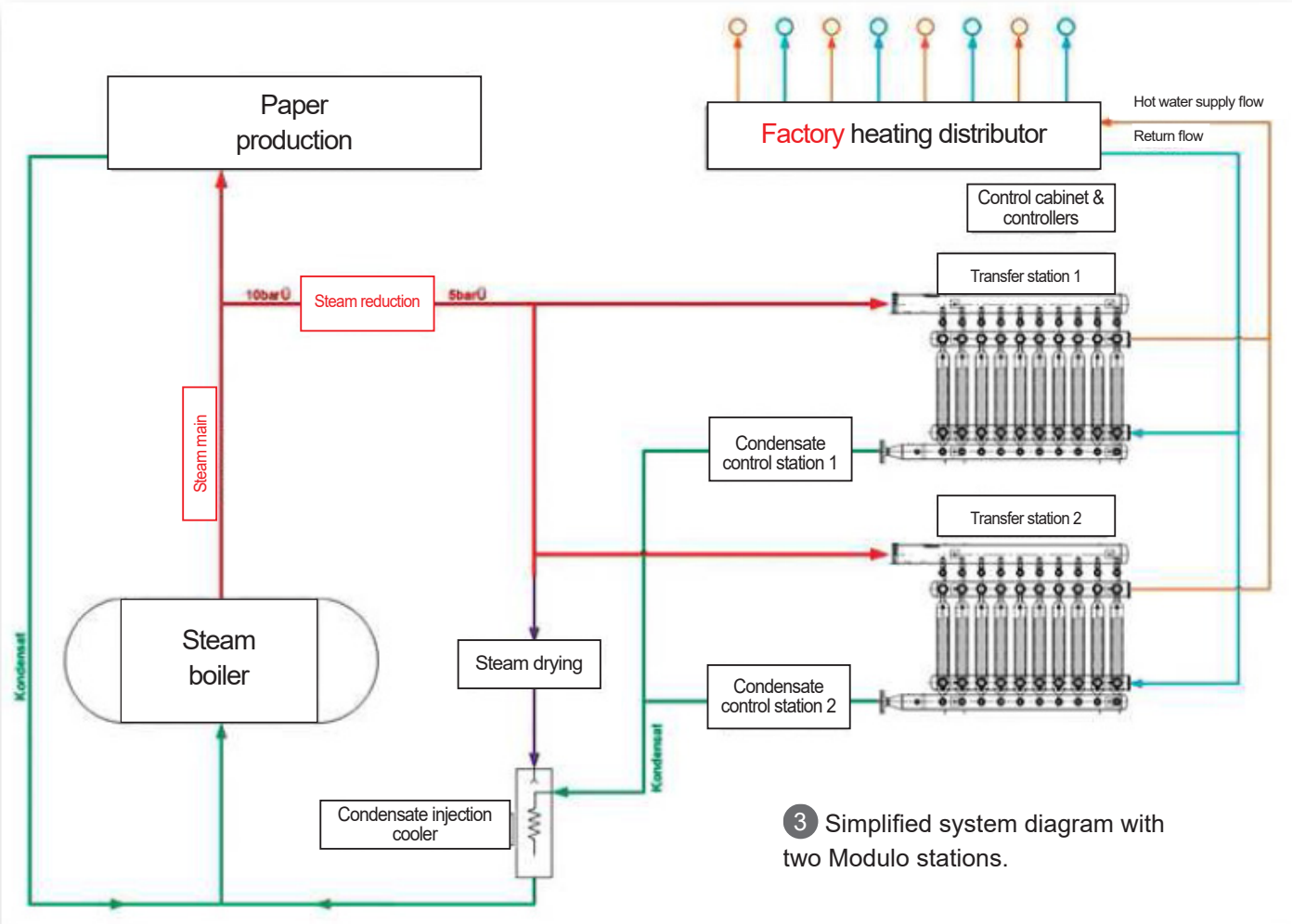
Only heat is required for preparation of the lining sheets – heating is done by looping the sheets around a steam-heated cylinder (pre-heater).
Steam at a temperature of about 180°C is used to heat the cylinder and rollers. Heat is also required to accelerate the subsequent gluing process. Therefore, hot steam at 180°C is a basic requirement for producing corrugated cardboard. Kunert Wellpappe in Biebesheim generate their hot steam in large gas-fired boilers 2.

Picture: W. Baelz & Sohn

2 Steam boiler in the boiler room at Kunert Wellpappe in Biebesheim.

Steam heat transfer stations
Rather than having a separate central heating system for the factory floor, some of the steam is diverted for heating purposes. This is recommended simply for reasons of space, but also because of the far higher efficiency achieved with just one energy centre.
Since the early 1980s, Kunert Wellpappe has been using steam heat transfer stations to condense some of the steam generated for production. In the heat exchanger, the condensing steam's thermal energy is transferred to the heating water on the secondary side for heating the factory floor.
Steam pressure is used to force the condensate from the heat transfer stations directly to the deaerator, from where it returns to the steam boiler for renewed steam generation.
Steam heat transfer stations are closed steam/condensate systems without condensate containers [1, 2]. The vertical stations used since 1984 (4 left) have a stainless steel shell and internal copper spiral tubes which ensure maximum heat transfer with comparatively small space requirements: steam enters the vessel from above and under high pressure it condenses along the copper tubes until it exits from the vessel as condensate.
Due to the old design principle with a large pressure vessel, the stations had to undergo a safety test (TÜV) every 5 years. These tests were time-consuming, because every station had to be taken out of operation and dismantled completely for the test. Although the stations worked reliably, it was decided recently to install a more modern and flexible system in order to avoid the organisational and financial drawbacks of the TÜV tests:
A modular Modulo steam heat transfer station with a manifold system 1. The station with ten modules 5 has replaced one of the two previously used heat transfer stations.

Modulo manifold system
The technical principle of steam condensation corresponds exactly to the previous system, but works on a considerably smaller scale. Every one of the three individual steam-filled copper shells per module contains copper spiral tubes through which the heating water flows for optimum heat transfer during condensation. The main advantage of this approach is that the modules are very small and the pressure/water content of the copper pipes is very low.
Hence, the legally specified TÜV tests – which are very time-consuming for the owner/operator – are no longer required.



3 Simplified system diagram with two Modulo stations.

Picture: W. Baelz & Sohn

3 shows a simplified system diagram with two Modulo stations . Heating the production hall in this way is far more energy-efficient than with the previous steam heat transfer stations.

Thanks to very low thermal losses, the 2.4 MW required by the previous station could be reduced to a primary energy consumption of 2 MW for the new plant. With the system being so much more energy-efficient, far less gas is needed to heat the factory floor. Furthermore, Modulo is very compact, has smaller dimensions and a lower weight.
In practice, there is another major advantage: individual modules can be replaced quickly during operation. For example, they can be removed for maintenance in a very short time, which results in optimum plant availability. However, it is also possible to change the number of modules at any time to adapt to changing requirements. In this way, output can be matched to the current demand by adding or removing modules.
Meanwhile, these positive properties of the Modulo heat transfer station have led to the decision to also replace the second original heat transfer station with a Modulo.

Picture: W. Baelz & Sohn

4 One of the previous steam heat transfer stations (left) and the new Modulo heat transfer station in the background.

Picture: W. Baelz & Sohn

5 Modulo steam heat transfer station with ten modules. For servicing purposes, the thermal insulation can be removed very easily.

COMPACT INFORMATION

At Kunert Wellpappe, two classical steam heating systems have been replaced with two modular, fully automatic Modulo steam heat transfer stations with a manifold system for heating the factory floor.
The Modulo is compact, smaller and lighter than the previous stations and has the great advantage of flexibility as the number of heat-exchange modules can be varied. Individual modules can even be removed and serviced during operation.
Due to the low pressure and low water content of the modules, no recurring safety tests (e.g. TÜV) are necessary for the Modulo. Moreover, thanks to minimised heat loss, the Modulo considerably reduces the energy input for factory floor heating.

Picture: W. Baelz & Sohn

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