Drycooling for Wieland's hot-rolling mill

From non-ferrous metal block to high-tech strip: Hot rolled and cold showered

Aerial photo: Full view of the Wieland plant in Vöhringen with modern hot-rolling mill

Line of business:	EPC
Application:	Machine cooling
Country / City:	Germany / Vöhringen
Fluid:	Glycol
Product:	Drycooler GFH

Wieland-Werke AG, Ulm, have recently replaced their approximately 30-year-old rolling mill for non-ferrous metals in the Vöhringen plant with a modern hot-rolling facility. In the new system, blanks 8 m long and weighing up to 14 tonnes can be “stretched” to a length of 100 m during the course of several rolling processes. The doubling of the rolling capacity brought with it a change-over from ground-water cooling to air cooling. Two drycooling systems, for plate cooling and the rolling frame, with a cooling power of 5 MW and 3 MW,

respectively, are installed, and work independently of each other. On the basis of the almost historic business relationship, Wieland decided on Güntner drycoolers of type GFH.

Wieland is one of the world's leading suppliers of special copper pipes for refrigeration and air-conditioning.

In return, Güntner cover the greater part of their demand for copper pipes from Wieland. The manufacture of semi-finished goods in non-ferrous metals is a very heat-intensive process. After the actual smelting, the raw blocks have to be put in the standard shapes for trade, such as coils, strips or cut plates. For this step of the process – called warm rolling – the raw block is first heated and then deliberately cooled down during the rolling process. Most of this withdrawn heat is at a comparatively low temperature, so utilisation of the heat is limited to only a few applications. The primary goal is to control the cooling process in such a way as to achieve optimum quality of material. Ground water has been used hitherto for cooling the 30-year-old rolling train.

Dry cooling preferred

After deciding on a new rolling train, Wieland were again faced with the question of how to cool the plates and rollers. Permission for use of water is mostly tied to usage – even if older water rights exist – that is, they are not transferable to new plants or expansions. Oswald Abler, Project Engineer at the Wieland-Werke AG in Vöhringen and jointly responsible for the energy supply, therefore had to plan the drycooling system for the new rolling train from scratch: "The law on water rights has changed a lot in recent years. It is no longer permitted to use ground water for cooling in systems of this size, as we did in the old system. We therefore planned for a cooling system with dry cooling right from the start."

A direct comparison between the various cooling processes, i.e. wet cooling towers, hybrid coolers and drycoolers, showed clear benefits for dry cooling. Abler says, "For several years now, we have been installing dry coolers by preference in other areas of the plant, too. Although air-cooled coolers take up more space for the same performance, they are quite simply more economical for many applications. In the case of water cooling systems, the permission application procedure is more difficult, because of vapour formation, for instance. And with air cooling, we can dispense with the treatment of water and the disposal of sludge."

Better quality through a cold shower

Because of the different cooling processes in the rolling mill and plate cooling, the drycooling plant is in two parts. The "rolling frame" cooler, with total cooling power of 3 MW, supplies the following rolling equipment with cooling water:

- Motor and bearings of the two warm rollers (electrical connection 2 x 2.0 MW)
- Emulsion tank
- Thickness measuring equipment

- Hydraulics (LP and HP)
- Oil lubrication system
- Coiler

Six Güntner type GFH drycoolers are installed, each with twelve fans (530 rpm; 770 W per fan). Each drycooler is 12 m long and 2.4 m wide, and weighs about 3 tonnes. The coolant is a 60:40 mixture of water and glycol. The water in the rolling-frame circulates at a rate of around 330 cu.m. per hour; there are two electric circulation pumps (operational/ reserve) with 75 kW power.

Aerial photo: Main Wieland Plant in Ulm

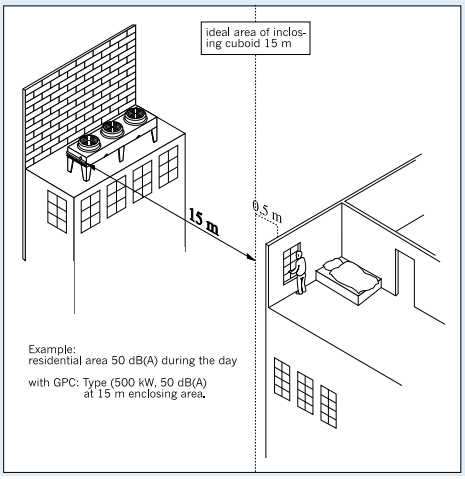
The "plate cooling" drycooler is used to chill the warm, rolled "strips" with an emulsion – the so-called quench water – from 600 °C to 150 °C. This quality-boosting process requires a large quantity of water in a very short time, so cooling power of 5 MW is needed. Here, too, the coolant is a 60:40 water glycol mixture in a closed circulation system. The flow volume is in the region of 450 cu.m. per hour, provided by two circulation pumps (operational/reserve), each with 75 kW of electrical power.

The actual process cooling is designed as an open, secondary circulation system with elaborate periphery, such as fin clarifiers, scale collector and sand filter etc. In this process, there is automatically a higher level of cooling temperature, so in winter the available warmth is introduced to the ventilation system in the building. This way, about 2,000 kW of waste heat can be utilised to heat the building saving a corresponding amount of primary energy.

The waste heat from the process is dissipated by eight Güntner GFH drycoolers of the same type and size as those used for cooling the rollers, but with more powerful fans (1.05 kW electrical power per fan at 620 rpm).

Standard version meets noise protection criteria

The new rolling train is situated right next to a residential area, so noise control was given top priority right from the planning stage of the drycooling plant. Although the final drycooling performance was not yet defined at this stage, it was possible to size the new drycooling plant with sufficient precision on the basis of overall noise expertise that was available for the Vöhringen plant. Otto Schmid from the Güntner Sales Office South describes how the decision was reached: "Because we had the noise protection expertise, we were able to use the maximum permissible values as a yardstick. Our philosophy is not to sell the customer the greatest possible number of drycoolers, but rather one drycooler of reasonable size and with acceptable noise emission. With the large range of fans we are able to cover a wide range of performance, even with a standard product like the GFH drycooler."

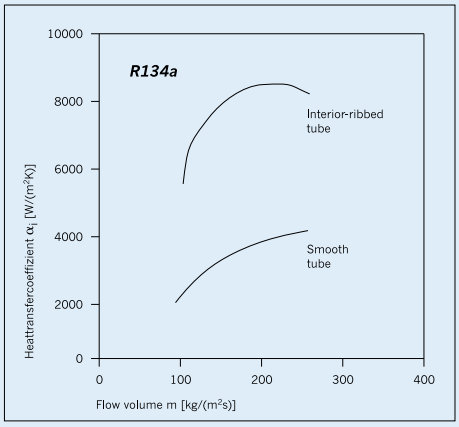


Immission control according toVDI guideline 2058

The new drycooling plant is not the first project with Güntner products at Wieland. Oswald Abler says, "We have been working together very constructively for years now. With Otto Schmid from Technical Sales at Güntner, we have solved every cooling problem up to now quickly and without any red tape."

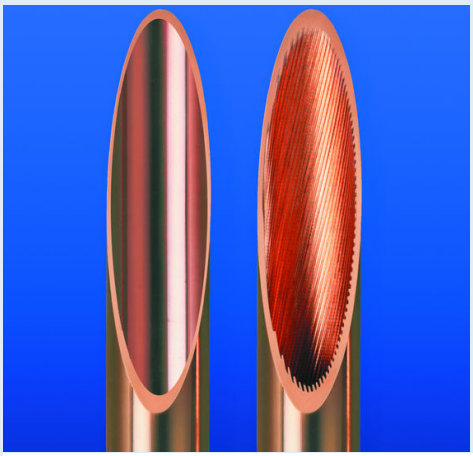
From continuous casting to high-tech semi-finished products

Archaic as the smelting of metals and alloys may seem even today, the degree of automation and precision in the further processing of ingots to strips, plates and tubes is all the more impressive. In the new rolling train at Wieland, the ingots, which are cast in moulds and are eight metres long, 200 - 250 mm high and up to 800 mm wide, are first heated to deformation temperatures of between 750 and 1050 °C – depending on the alloy – in a gas-heated rocker bar furnace. The downstream hot roller then reduces the thickness of the blank to 10 to 15 mm in a back-and-forth movement. The raw block lengthens with each run through the rollers until, at the end of the rolling process, it reaches a length of 100 m. The rolled-out casting dross and the oxides that have formed during rolling are then milled off at a cutting speed of 30 m per minute, leaving bare metal surface visible. In readiness for further processing, the "strip" is wound by a "coiler" (500 kW motor), or deposited in the strip store.



Comparison of heat transfer coefficient in smooth and interior-ribbed tubes

With process annealing and cold rolling, the coils or plates are given the final thickness the customer wishes, or given the ordered hardness. Slitting shears then cut the strips to the correct width. Most of the strips up to 0.5 mm thick are made into fabricated materials for electrical goods and electronics, such as lead frames for semiconductor elements, plug connections for telecommunications and vehicle electrics, high-frequency and underwater cables, or transformers. Other major precision strip costumers are the manufacturers of consumer goods such as metal ornaments, cutlery or musical instruments. Wieland is also one of the world's main suppliers of special copper tubes for refrigeration and air-conditioning applications.



Smooth and interior-ribbed tube