

Let it snow – with ductile cast-iron pipes from Duktus

Premium project at Willingen ski resort



Willingen ski resort in the Hessian Sauerland has seen Germany's most state-of-the-art chairlift system built in 2018 for around €10 million and the existing snow-making system was extended to include a new snow pipeline between the mountain and valley stations with ductile cast-iron pipes from Duktus. It will enable the slopes to be covered with technical snow far more efficiently in future.

The operators of the Willingen ski resort on Ettelsberg mountain in the Hessian Hochsauerland have been able to say "Let it snow" since 2007. At that time, around €18 million had been invested in expanding the ski resort and in guaranteed snow cover.

A Willingen Winter's Tale that graces the Ski Jumping World Cup location without the help of Old Mother Frost, including for downhill skiing.

The project was the first of its kind among the German ski resorts in terms of its scope. All of the big Willingen runs can now be covered with snow. Ductile cast-iron pipes from Duktus now guarantee the smooth running of the snowmaking facility on the ski slopes of the Ettelsberg mountain. "For the first phase of expansion, we had supplied Duktus pipes with the tried-and-tested BLS® connection and cement mortar coating (CMC) for the 13-kilometre pipelines. The snowmaking systems on the Mühlenkopfschanze are also operated with ductile cast-iron pipes from Wetzlar. Together, our ductile pipes and the guaranteed snow cover in Willingen are a real success story," says Karl-Wilhelm Römer, Regional Manager West at Duktus.

The positive experiences with the Duktus pipe system, the quality and reliability of technical support and the close links between the pipe manufacturer and those responsible at Liftgemeinschaft Köhlerhagen have really paid off.

In early 2018, Liftgemeinschaft Köhlerhagen decided to take a further step towards safeguarding the future and again opted for ductile cast-iron pipes for the expansion of its snowmaking systems.

K1 – coming soon...

K1 is the premium project in this town in the Central Uplands region with a population of 3500, which relies on winter and summer tourism for up to 85% of its income. [\(See Info 1\)](#)

"To make the resort an attractive place to visit in winter we need support," says Jörg Wilke, General Manager of Liftgemeinschaft Köhlerhagen. As well as the comfort that guests expect from the lift systems, guaranteed snow cover also plays an important role.

The key to success in keeping all ski resorts competitive is technical snowmaking. Guaranteed snow cover by means of technically produced snow is an important strategic factor in attracting visitors to the slopes at times of reduced snowfall. Tourists are more likely to visit areas with guaranteed snow cover.

Snowmaking is therefore an economic factor too. As well as adding value directly to the ski resort through gondolas and lift systems, technical snow also creates indirect added value in the region and has a positive impact on nearby hotels and restaurants. "We are therefore doing everything we can to guarantee snow cover from mid-December to mid-March for the benefit of all local service providers," says Jörg Wilke.

[\(See Info 2\)](#)

Stringent requirements for pipe quality

Project K1 and the associated expansion of the snowmaking capacity on the Köhlerhagen run, which has been extended to 1600 metres, and its new lift system primarily involves the laying of a snow pipeline along the edge of the run. Transverse pipelines to the Ettelsberg run are also being added.

The pipeline route crosses a sensitive area, home to valuable heath and matgrass vegetation, which is protected by the Habitats Directive (conservation of natural habitats and of wild fauna and flora). Close collaboration with the construction supervisors appointed for the project was therefore necessary in order to satisfy conservation requirements.

The following boundary conditions had to be observed:

- Extremely small incursions in the habitats, for example by restricting the width of the route to an absolute minimum. Work only to be carried out in small sections with immediate surface restoration once work is complete
- Pipelines to be concentrated into the narrowest possible trenches
- No transport of bulk materials along the pipeline route
- Use of neutral building materials; no foreign materials such as sand or pre-screened materials
- Concrete parts must feature an encapsulating, pH-neutral coating

"We have benefited from our experiences in the 2007 project, as the boundary conditions were the same," explains Karl-Wilhelm Römer. "The pipelines supplying water to the snow guns must at times be able to withstand extreme installation conditions, offer large safety reserves and have a long service life. The Duktus cast-iron pipe system with BLS® connections can be installed and secured in the prepared trenches in a short amount of time with minimal machinery requirements. Assembling the fittings for laying the pipes in curves and for the branch pipes to the snow guns is just as easy and reliable in the long term. The system can master complex surface topographies thanks to the deflection capability of the socket of up to 5° and can easily withstand the required water pressure of up to 100 bar."

The requirements of the Habitats Directive meant restricting the width of the pipeline route to a minimum and providing a suitable pipe material. Following consultation with the site planners and the owners of the ski resort, the decision was made to use ductile cast-iron pipes from Duktus in nominal diameters of DN 80 to DN 300 with zinc coating (200 g/m³), with a 5 mm plastic-modified cement mortar coating (CMC) and an internal coating based on aluminous cement. The key advantage of the Duktus cast-iron pipes used is that the CMC external coating eliminates the need for special protective and bedding materials such as sand. They also prevent the pH value in the soil from increasing, thereby guaranteeing adherence to the specifications of the Habitats Directive. The above nominal diameters also permit a component operating pressure of up to 100 bar and therefore guarantee the requisite level of safety for the smooth running of the snowmaking facilities. When it came to the internal coating, the fact that the water taken from the Hoppecke river for the snowmaking systems is untreated water with calcite-dissolving content was also taken into account. Over time, calcite-dissolving water can reduce the strength of cement-bound materials as a result of the disintegration of calcium carbonate contents. Aluminous cement coatings provide excellent protection here; this coating is applied to the pipes with a centrifugal rotation procedure and is therefore highly compacted. Aluminous cement mortars contain practically no free lime and are resistant to lime-dissolving water.

"The ductile cast-iron pipe system with BLS® connections makes it possible to produce tailored solutions, as is the case here. The external and internal coating provides maximum ecological protection for habitats and delivers long-term technical safety for the snowmaking systems," summarises Karl-Wilhelm Römer.

Start of construction for pipeline installation: April 2018

At the start of installation work, Duktus application engineers conducted comprehensive on-site training on the easy-to-install BLS® system with the team from main contractor Heckmann-Bau-Brilon.

By way of preparation for the pipeline installation trenches, the topsoil was carefully removed and placed to the side.

A trench-cutting machine was used to produce the narrow trenches. As well as the ductile cast-iron pipes, all other media pipes are installed in one and the same trench, i.e. all types of media along a total length of 37 km, from the cast-iron pipe to the delicate data cable.

In addition to the main pipeline to the Köhlerhagen run, two transverse pipelines to the Ettelsberg run and around 35 connections to the snow chambers are also installed. Approximately 16 km of pipelines made from ductile cast-iron pipes now run through the entire Willingen ski resort.

"By the start of the season in December 2018, nothing will remain of the construction site," says Jörg Wilke confidently.

Duktus – the Group

Ductile cast-iron pipe systems – from a single source

We employ over 300 people at our pipe production site in Wetzlar, Germany and at our sales subsidiaries. With a turnover of over €100 million, the Group is one of the largest European suppliers of ductile cast-iron pipe systems.

Duktus develops, produces and markets high-quality systems for water supply and construction infrastructure and for industrial applications, making a significant and sustained contribution to the construction and operation of high-quality water supply and waste water disposal infrastructure. Duktus products are of exceptionally high quality and are characterised by their outstanding technical and economic performance. A comprehensive range of fittings, produced at Keulahütte Krauschwitz, which has been part of the Duktus-vonRoll hydro Group since 2018, enables complete system solutions to be developed for every application.

Technical and economic performance

The base material for ductile cast iron consists of scrap steel and recycled materials from the casting foundry. No fossil resources (iron ore) are used, which preserves natural resources and helps sustainably reduce CO₂ emissions. The guiding principle is the efficient and environmentally friendly use of natural resources, more sustainable economic management and the return of raw materials into material cycles. Duktus has been a company of the Swiss vonRoll infratec AG since 2016.

Captions



Jörg Wilke (General Manager, K1-Willingen, left) and Karl-Wilhelm Römer (Regional Manager at Duktus) during a technical discussion



Newly constructed mountain lift station



View of the reservoir constructed in 2007



Pipeline installation/assembly in the open trench

K1 Köhlerhagen chairlift – Hesse's longest ski lift

After 50 years of pioneering Willingen winter sport history, the Liftgemeinschaft Köhlerhagen, a company of Ettelsberg Seilbahn Willingen, is replacing both the Köhlerhagen 1 and 2 T-bar lifts with a safe, comfortable and powerful eight-seater chairlift at Alpine level. The new chairlift can transport 3600 people per hour.

K1 will be the world's first eight-seater chairlift of the latest D-Line generation from cable car manufacturer Doppelmayr based in Wolfurt, Austria. In another world first, different seat types are used for summer and winter operations. In addition to the dimensions and performance specifications tailored to the conditions in the Central Uplands region, the system, the first chairlift north of the Alps, will also feature comfortable weather protection hoods. The chairlift will be opened for skiers and snowboarders at the start of the 2018/2019 winter season and for mountain bikers from summer 2019. Changing between winter and summer chairs is remarkably simple. During summer operations, bikes can be suspended from the rear of the chair.

The Köhlerhagen run is also undergoing major optimisation; the existing run is being extended upwards to the new mountain station near the summit cross and downwards to the new valley station at the former sports centre. The "Köhlerhagen" run will then be more than 1600 m in length. A total of 27 snow guns from TechnoAlpin based in South Tyrol will provide snow cover. Yet another milestone: The Köhlerhagen run will be one of the first in Europe to be operated with energy-efficient LED lighting.

For reasons of nature conservation, the run will be moved slightly to the east in the area beneath the steep slope up to the crossing of the "Waldhotel tunnel". The crossing at the approach to the Waldhotel was already eliminated in 2016 with a road tunnel. The "Zur Ruthenaar" road and the flow of the Hoppecke river were routed beneath the run in a large tunnel in much the same way in 2018. From the 2018/2019 season onwards, the entire Köhlerhagen run will therefore be free from all inconvenient and dangerous crossings with other traffic zones.

This project will make it much easier to move between the two Willingen ski mountains of Ettelsberg and Hoppertkopf/Ritzhagen.



Helicopter installation

One of the highlights of the cable car construction at Köhlerhagen was the installation of the supports by a heavy-transport helicopter. With targeted planning, 13 of the 14 supports for the chairlift could be positioned in such a way that they could be easily installed by a truck-mounted crane. This proved more difficult, however, for support 8 at the steepest part of the Köhlerhagen slope. To reduce technical complexity and preserve the surrounding matgrass, the decision was made to install this support by helicopter. On 25th July 2018, the KAMOV, a special helicopter from Swiss company HELISWISS, hovered into Willingen. Following a briefing of everyone involved in construction and the preparation of the components to be flown in, everything happened extremely quickly. The four components (support shaft, yoke and the two sheave assemblies) were suspended in turn and flown to the site, where they were then secured in place. While the ground crew were tightening the main screws, the KAMOV was already fetching the next supplies. In a record-breaking 18 minutes, all parts were on site and in the right place.

Info 2

Technical snow – it's all water and air in the end

It's not just German beer that is subject to a purity law. The production of technical snow also requires a certain degree of purity: Water and air and nothing else. Like natural snow, technical snow consists purely of water and air.

As is the case with natural snow, the water has to be converted to a different state of matter. During the production of technical snow, ice-forming nuclei on the snow guns produce a mixture of water and compressed air, which forms snow cores (so-called nuclides) when exposed to the atmosphere. The nozzles of the snow guns atomise the water into fine droplets, which join with the nuclides. From this point onwards, the process of producing technical snow is identical to the natural process: Once the air is cold enough, the water droplets freeze and fall to the ground. The difference is that the water does not have as much time to freeze on its way to the ground. Depending on the air humidity and temperature, natural snow has enough time on its long journey from the clouds to the ground to crystallise and form hexagonal crystals in an infinite number of different shapes. In the case of technical snow, the water droplets freeze from the outside in and fall to the ground as small balls of ice.

This route is simulated differently by different snowmaking systems; snow guns use a blower, whereas snow lances use the natural drop in height of up to ten metres. The fine adjustment of the nozzles enables snow to be produced in a variety of different qualities. In contrast to natural snow, the quality of the snow produced in this way can therefore be kept constant, even under changing weather conditions.

Technical snow is more dense and harder than fresh natural snow. It is more suitable than natural snow for modern winter sports resorts as it is easier to process than some forms of natural snow.

Technical snow is better able to withstand the load of the steel edges of skis and snowboards, is less likely to freeze and thaws at a slower rate. The latter is due to its density. One cubic metre of technical snow weighs up to 480 kg, whereas fresh powder weighs just 10 to 60 kg and sticky snow weighs a maximum of 150 kg. The higher density is related to the structure of the crystals. The snowflakes in a covering of powder snow are spaced apart, whereas the compact grains in a covering of technically produced snow lie close together. The larger the ratio between the surface and the volume of a body, however, the more resilient it is to external influences such as rain, wind and heat. Powder snow caves in quickly, so only wet, compacted old snow reaches the specific weight of technical snow.

A 20 cm covering of technically produced snow therefore corresponds to a fresh natural snow covering of 50 to 60 cm. It would take a considerable amount of time for such a quantity of snow to thaw completely in the Hochsauerland, even under unfavourable weather conditions.

Snowmaking systems produce snow in a natural way, using water and air, powered by electrical energy. To assess the amount of energy required, a simple comparison can be drawn. It takes around 37,000 kWh of electricity per season to cover a ski slope that is 40 metres wide and one kilometre long in snow. A public sauna requires 350,000 kWh and an ice rink around 1,300,000 kWh.

Snowmaking systems do not pose a threat to natural vegetation. They protect the slopes from mechanical loads and preserve the vegetation. This fact is supported by scientific evidence. A compact layer of snow protects nature during the cold months and also has a positive impact on vegetation throughout the rest of the year. The covering of snow thaws slowly in spring, so the water used to produce snow is gradually fed back into the ground.

Just a few years ago, temperatures of -5 °C were required in order to produce the necessary snow quality. Today, the snow-making systems work at -2 °C, depending on the air humidity. When the air is particularly dry, fine snow crystals fall to the ground at temperatures just below 0 °C. The snowmaking systems provide their best output below -10 °C.