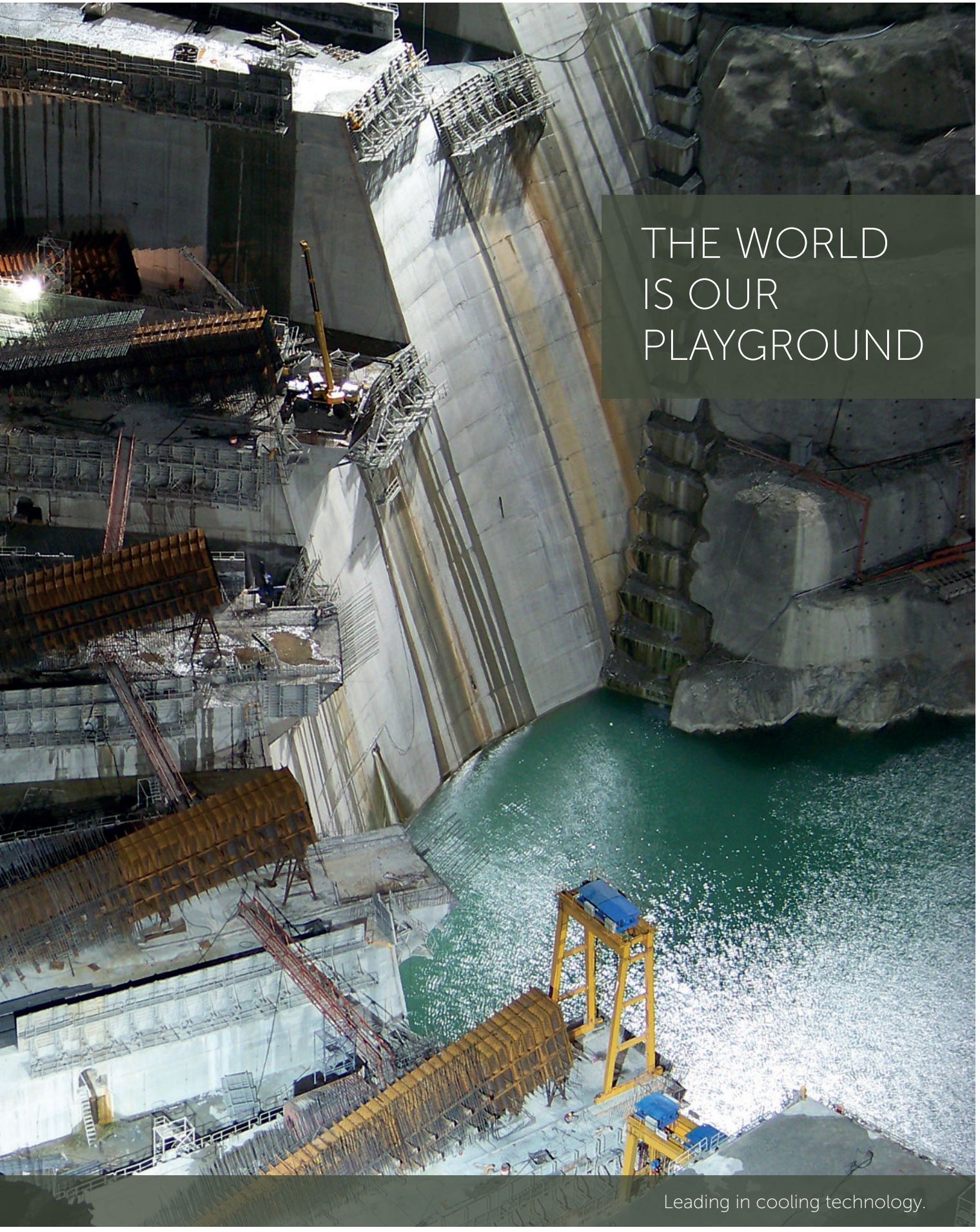


THE WORLD IS OUR PLAYGROUND

Leading in cooling technology.

NR COOLING
services

INTRODUCTION

NR Cooling Services is a leading supplier of cooling and air treatment systems. We offer high-quality, innovative and comprehensive solutions in the field of marine and concrete cooling, industrial and process cooling technology, climate control, ventilation and central heating.
We are an experienced partner at the global level with respect to the design, construction and installation of cooling and ventilation systems.

Our installations are always customer-oriented, thanks to our skilled team of engineers that fully understands the wishes of our customers.
There is virtually no climate control or cooling request imaginable that we would not be able to satisfy. For us, being customer-oriented means that your needs and wishes are our number one priority.

By using advanced cooling technology and operating systems, we provide solutions to our customers in the ship and yacht building industry, major contractors in the construction industry, concrete production companies, (petro-)chemical industry and food industry as well government agencies.

NR Cooling Services has received all prestigious certifications including ISO9001.

OUR CUSTOMERS

NR Cooling Services provides cooling, heating and ventilation solutions to five distinctive customer groups. These groups are served by five dedicated teams working closely together, sharing their knowledge and experience.

Civil engineering

Our civil engineering division is worldwide known for its innovative cooling, heating and ventilation solutions used in concrete production, tunnel drilling, tunnel ventilation and mining. Our solutions are used worldwide, from Panama to Australia and from Laos to Brazil.

Shipping and yachting

The shipping and yachting division serves two different markets. The commercial vessels like dredging vessels, cargo ships and cruise ships. The second market is the luxury yachting industry, with its special need for state of the art finishing and controls.

Offshore

The offshore division, manufactures and supplies complete cooling, heating and ventilation solutions to our offshore customers such as oil-rigs, drilling platforms, heavy crane vessels. Our systems are special designed to meet the hard conditions at sea, as well as meeting specific safety recuirements.

Utility

The utility division focuses on providing complete cooling, heating and ventilation solutions for offices, public buildings like railway stations and museums, as well as cooling systems for computer data centers, and the leisure facilities like ice rinks and snow slopes. Each of those solutions meet the specific needs and operating conditions of our customers.

Industry

The industry division manufactures and supplies complete cooling, heating and ventilation solutions to our industry customers, such as steel production, (petro-)chemical, pharmaceutical and food industry. Our solutions are responding the widely varying needs of our diverse customer base.

CONCRETE COOLING

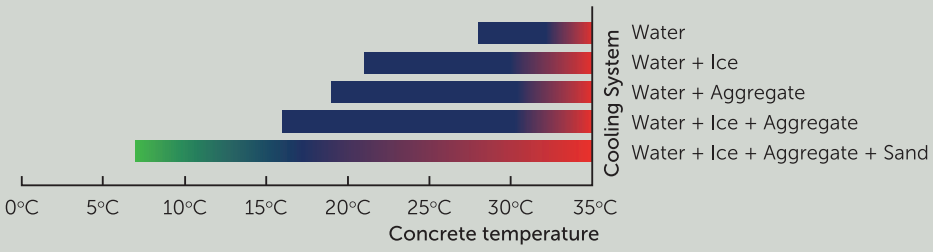
Our team has more than 40 years of experience.

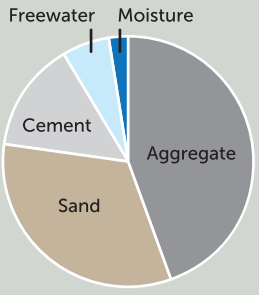
Concrete cooling can be applied before, during and after the concrete production process.
Concrete cooling is a prerequisite in environments where concrete is used in large volumes and where outdoor temperatures are high.
But concrete cooling is also applied in the case of structures where large temperature differentials can occur or where there is a large temperature drop between the two sides of a structure.
In all these cases, concrete cooling is used in order to prevent the concrete from fracturing.

Methods of concrete cooling
The concrete cooling process can be performed in various ways.

The most common methods are:
- Chilled water
- Flake Ice
- Aggregate cooling by water
- Aggregate cooling by air
- Sand cooling by air.

ACHIEVABLE CONRECTE TEMPERATURES





CHILLED WATER

The most simplest method of cooling concrete is using chilled water in the concrete mix. The chilled water is produced by a chilled water plant consisting of a chiller unit capable for cooling down warm water to 4°C or less, in combination with an chilled water buffer and supply pumps.

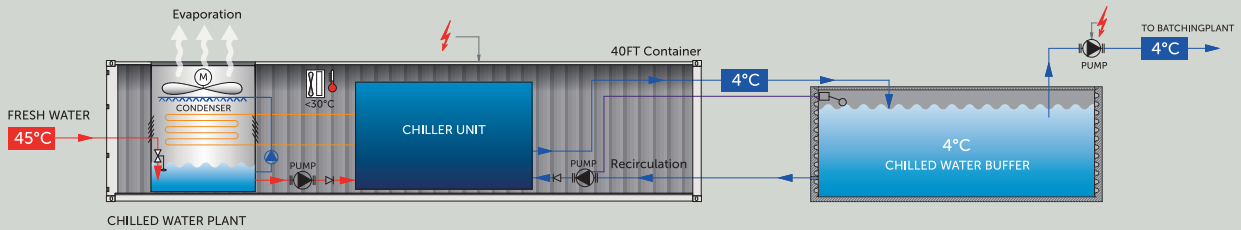
How it works

Water, even up to 45°C, is fed into a chiller unit, which cools down the water to a temperature between 1°C and 4°C. After cooling down, the cold water is stored in an insulated buffer tank. According to the daily cold water demand for the concrete production, these buffer tanks are made of prefab elements or a concrete construction. Supply pumps connected to this cold water buffer basin supplies the cold water to its consumers, like concrete mixers.

The effect of chilled water is limited by the maximum water content in the concrete mix, the actual water amount that can be added to the mix is the total water content minus the moisture content inside the aggregate and sand which can be 20-40% of the total water.

By adding 33 kg/m^3 of cold water of 4°C to the fresh concrete the temperature of the concrete drops 1°C compared to using water of 45°C.

PROCESS CHILLED WATER



AGGREGATE COOLING BY COLD AIR

Concrete consists of 40% to 60% aggregate with sizes of 5 mm up to 150 mm. When high concrete production rates and extreme temperature reduction are required, cooling aggregate by air has proven to be very effective. When using this technology, the limitation of added water is not a limiting factor in reaching the desired concrete temperature. This means that lower concrete temperatures can be reached compared to other common systems.

How it works

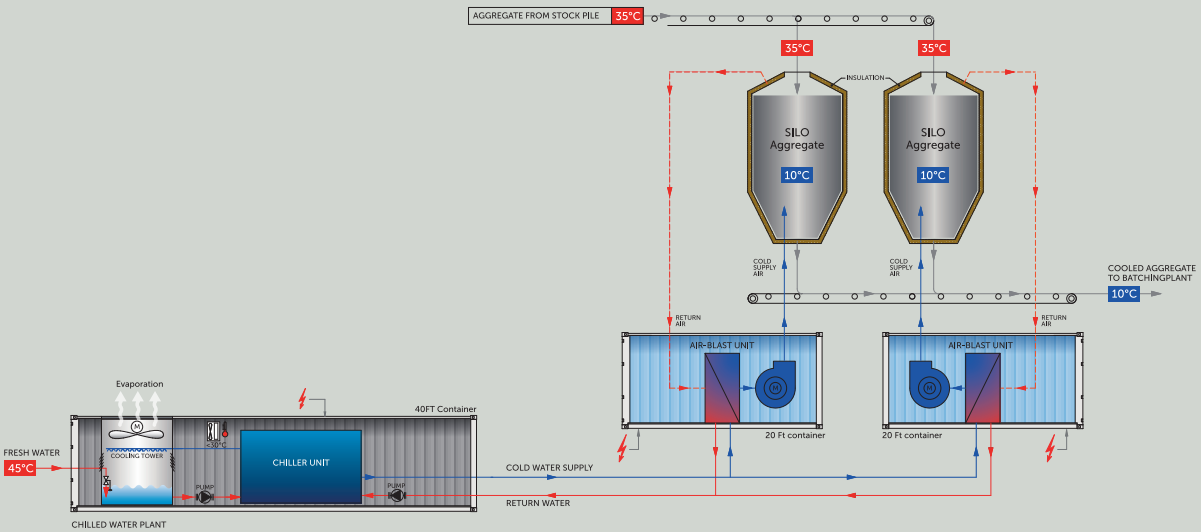
Aggregate is transported by conveyor belt from the stockpile into the storage bins of the batching plant, or in special designed aggregate cooling silos standing in-line with the batching plant.
The aggregate cooling system consisting of an air-blast unit connected to a refrigerating unit or chiller, which produces cold air. A blower fan forces the cold air through the aggregate, while they are stored inside this bin/silo, using a special air diffuser system. To increase the cooling effect and to lower cooling power needed, the air leaving the aggregate at the top is collected and fed back to the air-blast unit. The cooled aggregate is extracted from the bin/silo and fed into the mixer.

The final temperature of the aggregate depends on the dwell time of the aggregate inside the cold air stream, and the size of the aggregate. For this reason the volume of the bin, in which the cooling process takes place, is very important for optaining the best result. Depending on the concrete demand multiple silos can be installed to meet capacity needs.
A big advantage of cooling aggregate by air is the compact size of the cooling plant and saving of electrical energy compared to the same effect by using flake Ice.

Within the concrete cooling industry our team uniquely masters this cooling technology for high capacity systems and extreme temperature reduction needs.

Aggregate is one of the biggest components in the concrete mix and hence its effect on concrete temperature is very high. By lowering the aggregate temperature by approx. 2°C, fresh concrete temperature will drop by 1°C.

PROCESS AGGREGATE COOLING BY AIR



AGGREGATE COOLING BY COLD WATER

Instead of cooling aggregate by air, it can also be cooled by inundating it in cold water.

How it works

Aggregate is transported from the stock pile onto a special conveyor belt which is placed inside an insulated tunnel, so called wet-belt.
During the transportation time on this belt cold water, produced by an cold water plant, is sprayed on top of the aggregate to cool them down by the effect of inundation.

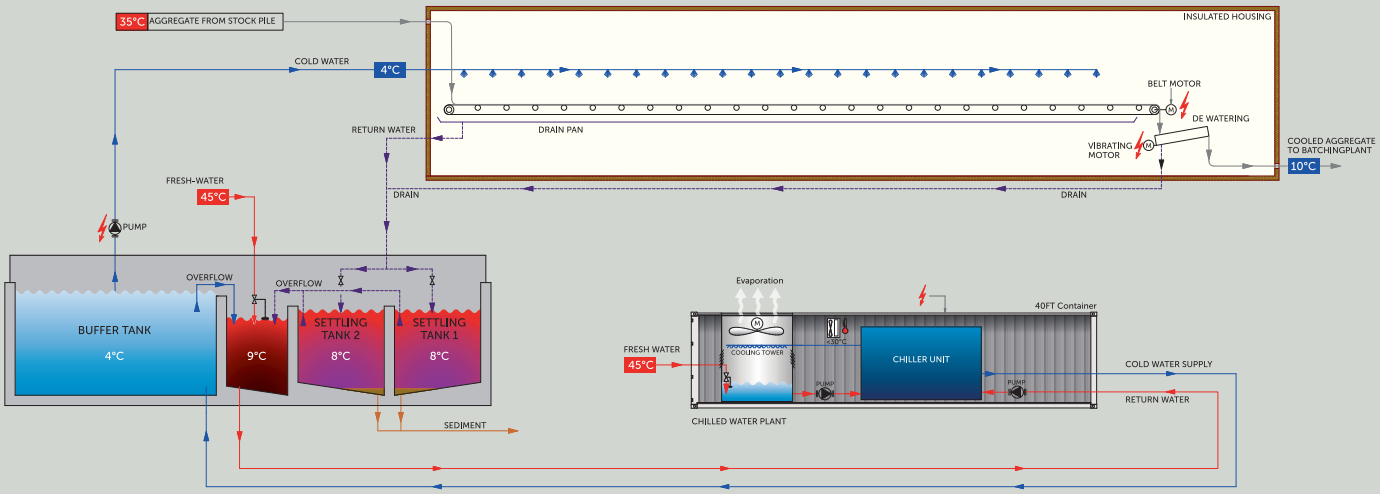
The cold water flows through the aggregate in opposite direction and is finally collected by a drip pan located underneath the belt. From this point the used water is transported to a sedimentation system for cleaning. After that the water is pumped back to the cooling plant.

The cooled aggregate leaves the wet-belt at the end falling onto a dewatering screen, to separate the remaining water from the aggregate, and then transported to the batching plant.

The temperature of aggregate leaving the wet-belt is determined by the holding time on the belt in cold water, and the size of the aggregate. The bigger the size the longer the required holding time.
This system requires a sedimentation system as well as the specific lengths of the belts which may require a larger surface compared to air cooling.

Aggregate is one of the biggest components in the concrete mix and hence its effect on concrete temperature is very high. By lowering the aggregate temperature by approx. 2°C, fresh concrete temperature will drop by 1°C.

PROCESS AGGREGATE COOLING BY WATER



SAND COOLING BY AIR

Concrete consists of 30% to 45% sand. In combination with other technologies sand cooling by air can be used to reach the desired fresh concrete temperature.

How it works

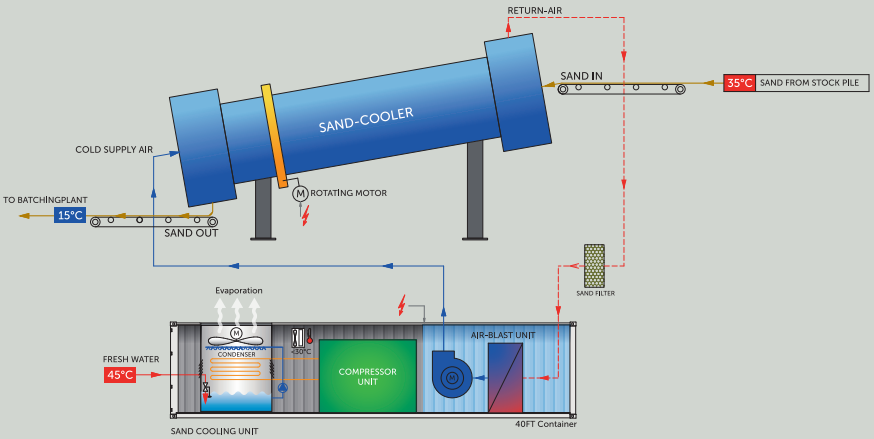
Sand from the stockpile is transported by a conveyor belt directly into the rotating drum of a sand cooler. The sand passes through the sand cooler caused by gravity and a rotating movement of the drum.

During the remaining time of the sand inside the sand cooler, cold air is blown trough the sand, lowering its temperature. This cold air is produced by a air-blast unit in combination with a refrigerating unit.

At the outlet of the sand cooler the air is separated from the sand by a special separator, the air goes back to the air-blast unit and the sand falls down on a second conveyor belt which transports the cooled sand to the batching plant.

To lower the fresh concrete temperature by 1°C, sand should be cooled down by approx. 3°C

PROCESS SAND COOLING BY AIR



FLAKE ICE

The most frequently applied cooling method for lower fresh concrete temperatures is replacing the mixing water by flake ice.

How it works

Flake Ice is produced by rotating ice makers connected to a refrigerating unit. The produced flake ice is subcooled and dry, which makes it possible to store inside a deep cooled storage bin. Inside this storage bin a special designed rake system transports the Ice from the bin storage to an elevating screw conveyor.

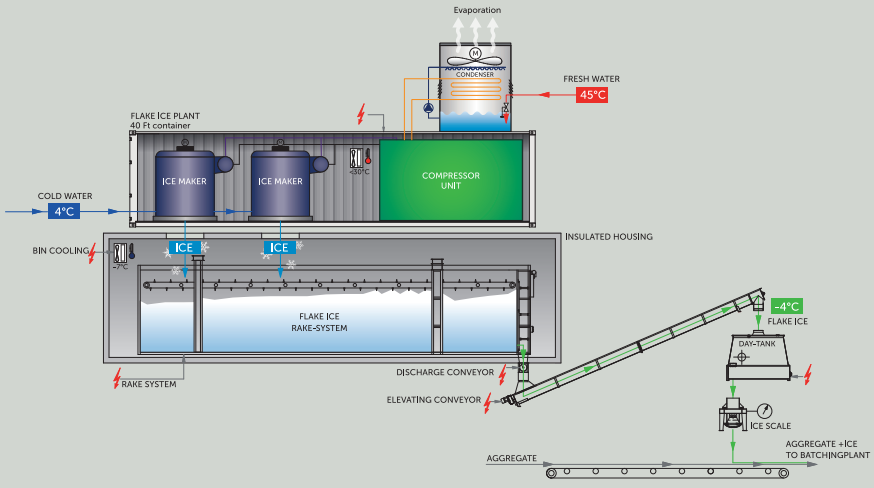
The screw conveyor drops the Ice into an Ice scale to weigh the right amount of ice, which must be added to the concrete mix.

The ice is mostly dropped directly on the aggregate feeding conveyor of the batching plant, but also directly into the mixer.
When large volumes of concrete are produced at high speed it's common to place a day-tank between the conveyor and the Ice scale, working as an inline buffer to speed up the loading of the scale.

The use of flake ice is limited by the maximum water content allowed into the concrete mix.

Flake ice has a powerful cooling effect, caused by the conversion energy from solid ice to water, to lower the fresh concrete temperature by 1°C about 7,5 kg/m^3 of water must be replaced by flake ice.

PROCESS FLAKE ICE



TUNNEL AND MINE SHAFT VENTILATION

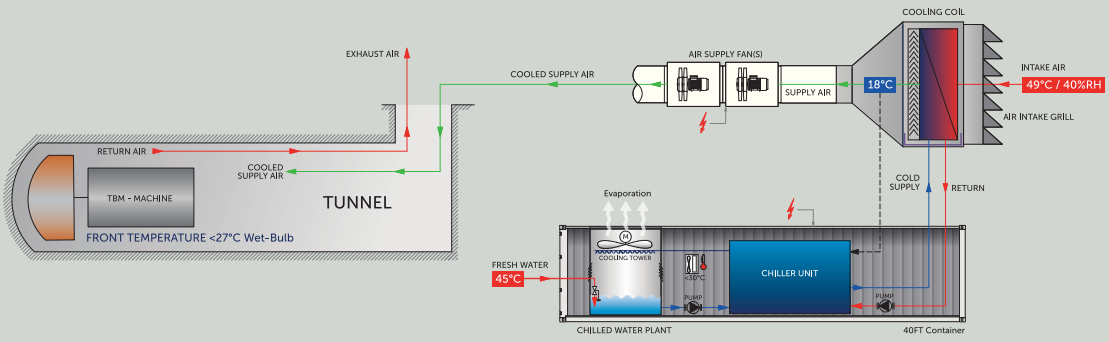
There are strict rules about the working climate inside tunnels and mines. Ventilation requirements are dictated by the desired conditions.

How it works

The necessary ventilation air is blown into the tunnel using multiple fan systems and air-ducting.
This ventilation air will be temperature controlled by a special designed cooling/heating coil.
The cooling coil is connected to a chiller or heater unit as required. The ventilation system is controlled to monitor and maintain the required conditions.
This central unit solution avoid the needs for multiple smaller units placed inside the tunnel or shaft.

By installing this ventilation concept, the required conditions inside the whole tunnel are maintained.

TUNNEL AND MINE SHAFT VENTILATION



TBM COOLING

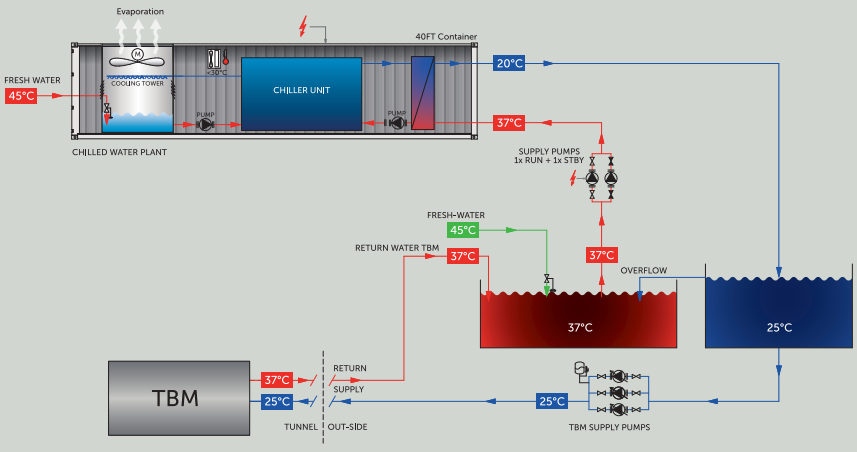
Equipment used in the mining and tunnel industry, such as a Tunnel Boring Machine (TBM) needs cooling water to control the temperature of the machinery.

How it works

Depending on the location of the project (hot or cold climate) the cooling water of the TBM is cooled by a cooling plant consisting of a cooling tower or a chiller unit, or a combination of both. Warm water from the return basin is extracted and pumped through the cooling equipment and collected in a cold water basin.

Environmental and project conditions determine the selection of the cooling solution.

PROCESS TBM COOLING



RENTAL AND REFURBISHED EQUIPMENT

Rental equipment

NR Cooling offers a wide range of chiller and ice making equipment. Our inventory is available on short notice and installed worldwide. Our team is available to provide a solution that best fits your needs.

Advantages of rental solution are:

- Rapid response
- No investment
- Flexibility

Refurbished equipment

Also we have a range of refurbished equipment inventory for sale such as:

- Chillers
- Compressors
- Ice makers
- Complete Ice plants

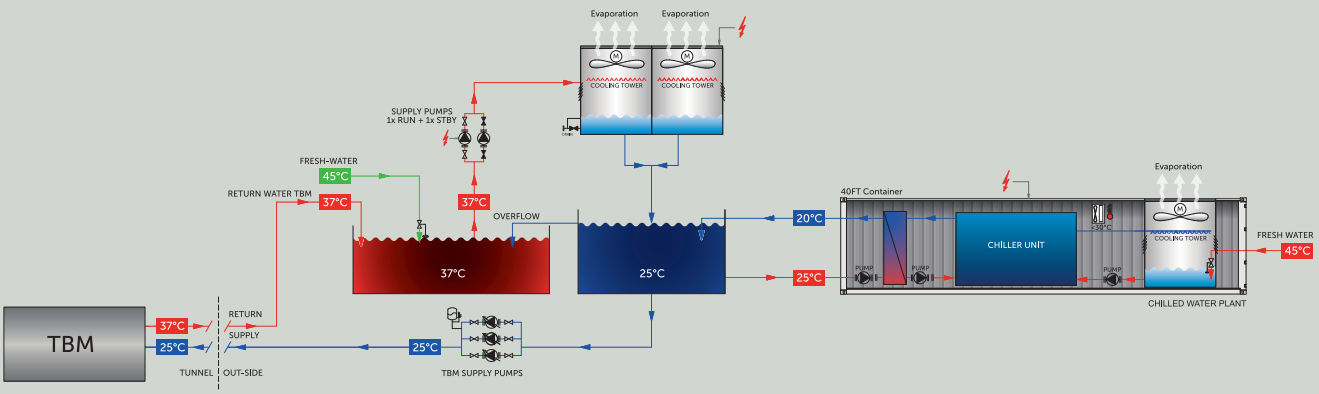
Our refurbished equipment is tested and ready to use.

The teams of NR Cooling Services are dedicated to help you 24/7.

T +31(0)180-545 111

E sales@nrcooling.com

www.nrcooling.com



SOME OF OUR PRESTIGIOUS REFERENCES

Boyabat

Turkey

8x Aggregate cooling by Air 680 kW

2x Flake ice plant 132 Ton

2x Rake system 72 Ton

6x Chilled water plant 1000 kW

1x Hot water system 2750 kW

Alqueva

Portugal

1x Flake ice plant 100 Ton

1x Rake system 72 Ton

4x Chilled water plant 1100 kW

1x Chilled water plant 300 kW

G.E.R.D

Ethiopia

2x Flake ice plant 200 Ton

2x Rake system 72 Ton

12x Aggregate cooling by air 700 kW

12x Aggregate silos 250 m^3

2x Hopper cooling by air 400kW

8x Chilled water plant 1150 kW

Panama C

Panama

2x Flake ice plan

4x Rake system

2x Aggregate we

4x Sand cooling

2x Chilled water

2x Hopper cooli

Ichthys LNG

Australia

2x Flake ice plant 100 Ton

2x Rake system 100 Ton

2x Chilled water units 1200 kW

Yusufeli Dam Project

Turkey

5x Aggregate cooling by Air
600 kW

6x Flake Ice plant 100 Ton

3x Rake system 75 Ton

5x Chilled water plant 950 kW

1x Hot water system 950 kW

Doha Red Line

Qatar

5x Tunnel ventilation cooling
1100 kW

2x TBM Cooling water 1500 kW

1x TBM Cooling water 750 kW

5x Water heat-exchanger 2400 kW

Canal

t 336 Ton

72 Ton

t-belt 5450 kW

system 775 kW

plant 1075 kW

ng by air 200 kW

Saudi Ready Mix

Saudi-Arabia

1x Flake ice plant 74 Ton

1x Chilled water unit 150 kW

1x Rake system, 75 Ton

Deriner Dam

Turkey

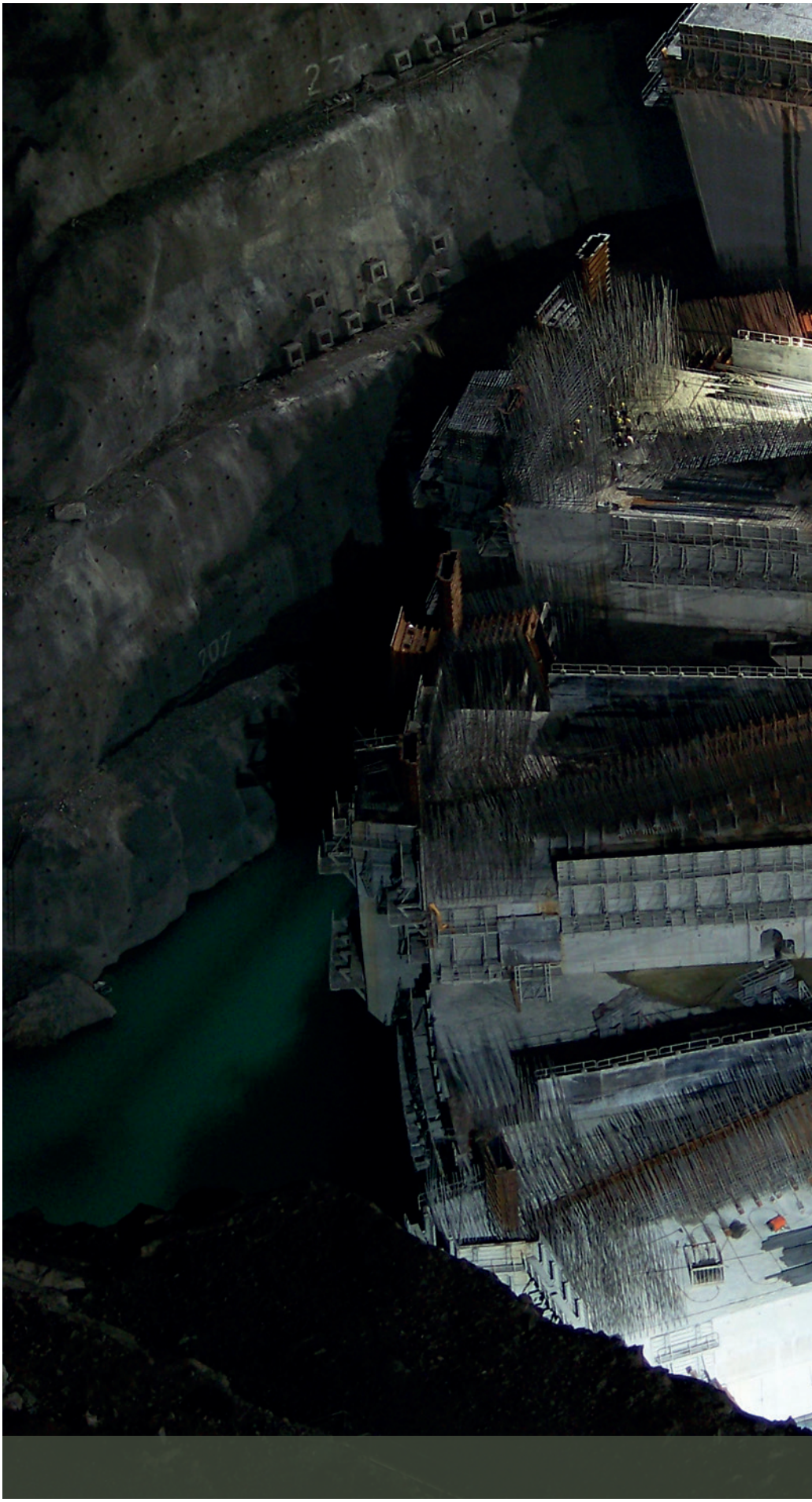
3x Aggregate cooling by
air 425 kW

1x Flake ice plant 200 Ton

1x Rake system 100 Ton

2x Chilled water plant 910 kW

All references are projects of NR Cooling Services or the legal predecessor.



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