

INTRODUCING THE WORLD'S BEST

Hot water and steam boilers



In harmony with your economy and the environment

Z&I
ZANDER & INGSTRÖM



We have clients and commissions worldwide. Here is a representative selection.



UKRAINE

Uman Greenhouse

Commission: In 2011, Zander & Ingeström installed a 40 MW hot water boiler at Uman Greenhouse, one of Ukraine's largest producers of tomatoes and cucumbers. Thanks to cheap night-rate electricity, our customer can run the boiler at full power and simultaneously charge the hot water accumulator.



GERMANY

Saarbrücken/Ludwigsfelde, Flensburg, EON-Shamrock

Commission: Germany has a long history of installing plants that generate renewable electricity using wind and sun. To take care of the surplus electricity that naturally occurs in these facilities, our boilers are installed. They convert the surplus electricity to heat/steam that can then be distributed into the district heating network or to an industrial business.





The Great Wall of China, one of the world's new seven wonders, is nearly 9,000 km long. But it cannot be seen from the moon.



CHINA

Anguang, Jilin, Changchun, Rizhao

Commission: In 2013, we delivered four different plants to China. These boilers utilize low electricity rates at night and temporary surplus of electricity from wind power. The largest plant in Rizhao consists of four 40 MW boilers, making it the world's largest electric boiler plant. The entire delivery included 11 boilers, with a total output of 250 MW. Furthermore, we deliver auxiliary steam boilers to four Chinese nuclear power plants in Haiyang, Changjiang, Rongchen and Lufeng.



SVERIGE

Hallsta Paper Mill

Commission: We were asked to reinforce the boiler house at Hallsta Paper Mill, where we previously supplied a 40 MW boiler. The new boiler has a capacity of 60 MW and a design pressure of 32 bar, making it the largest in Sweden. Hallsta Paper Mill is one of our oldest customers. In 1917, our company's founder, Bengt Ingeström, supplied Hallsta with a steam accumulator.



Produce heat/steam at night and use it during the day. That is a wise policy.



Each time power is lost we are invited on an unwanted trip back to the days before civilization. The entire modern society is dependent on a stable supply of electricity, and it being produced around the clock. The problem is that electricity cannot be stored, and must be consumed at the same time and the same rate as it is provided. Electricity that is not used is wasted, without doing any good. This happens every night when most electric power-driven machines and appliances are not in use.

Zeta boiler, a future wise investment

An elegant solution to the problem of excess electricity is to allow an electric boiler to convert it to steam or heat that can be utilized in district heating and industrial processes. This is a solution that is highly interesting for power and process industries that advantageously can allow the boiler to work at night when electricity is available at low price.

The world's best electric boiler is called Zeta, and is manufactured by the Swedish engineering firm Zander & Ingeström in two basic models: a boiler for steam production in industries and power plants, and a model for hot water production in plants and hot water networks.

The electric-powered Zeta boiler thus replaces all heat and steam boilers fueled by oil, coal and other fossil fuels, whose flue gases contribute to global warming and pollute soil and water. Investing in a Zeta boiler is, in other words, also an investment in a cleaner environment.

Several areas of usage

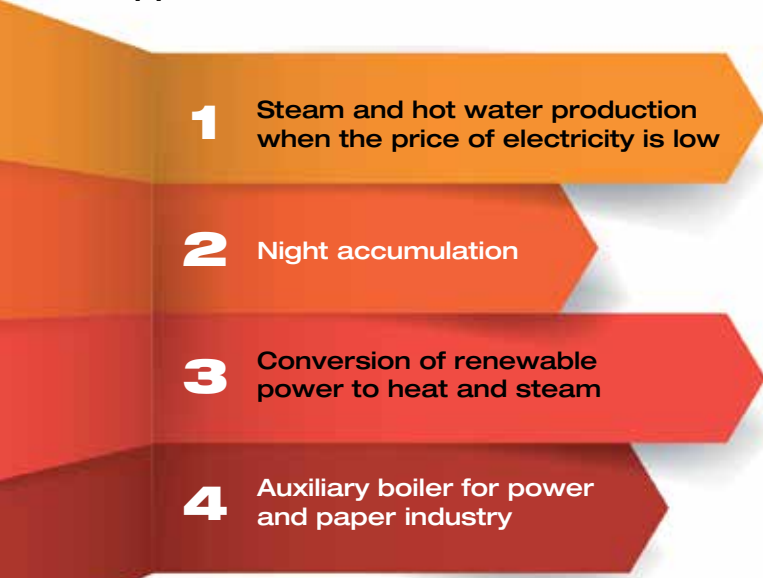
Using excess electricity with the help of Zeta boilers has long been common in northern Europe, where the availability of electric power has been historically good, with large surpluses from hydro and nuclear power. But there are more uses. An electric boiler is perhaps more expensive to run than a fossil-fired boiler during the day – but



A geyser is a hot spring where boiling water or steam spurts out of the ground, like nature's very own fountain. The word *geyser* comes from the name of a single Icelandic geyser, Geysir.



The Zeta boiler's applications:



usually not at night when electricity prices are lower. Consequently, we at Zander & Ingeström have installed a large number of accumulator plants in, among other places, China, where the steam/heat is produced and stored overnight and then used during the day.

A third application area has arisen due to the rapid expansion of green power in Europe (wind, biogas and solar). These grids need to be regulated for the obvious reason that a wind turbine, for example, produces electricity when the wind blows – not when the industry presses the on button. This fact is the reason why more than 25 Zeta boilers are in operation in Denmark alone.

A fourth application assists the power industry, where the Zeta boiler acts as an auxiliary boiler. It generates steam when the plants start up, and it provides steam production when the plants are shut down.

Zander & Ingeström has supplied boilers for power plants in France, Germany, China, Finland and Sweden.

Figure 1



The needs are global, the solution is at our office in Sweden



The market for electric-powered heat and steam boilers is global. All industrialized countries have the same energy needs and have to take into account the conditions and rules concerning economy and the environment (see Figure 1). That is why the phone rings here at Zander & Ingeström wherever in the world the need arises, because it is common knowledge that we deliver the best boiler and the best total solution.

Zetas development

Our leading position in the world is no accident, but a natural consequence of long and dedicated work, based on solid technical expertise and a visionary product.

The engineering company Zander & Ingeström was founded in 1898, and built the first electric boilers already in the 1920s. Customers gave the thumbs up but wanted larger sizes and higher voltage, which started the actual

development of the Zeta boiler, whose international breakthrough came in 1932 with six boilers sold to Finnish Enso. Since then we have delivered thousands of boilers, ranging from a few kW to complete plants up to 150 MW.

We are, objectively, the most qualified supplier of electric-powered steam and heat boilers. We have not only built the largest boilers, but also installed by far the most.

Zeta's characteristics

Today's Zeta boiler is the fruit of long practical experience, where our products and systems have been refined close to perfection. The result is a boiler that is characterized by high reliability, extremely high efficiency and low noise. The capital cost is low and the need for maintenance minimal (see Figure 2).



◀ Our customers are from all over the world with a particular emphasis on Europe and Asia, where we are represented by local dealers and workshops.



Water's boiling point is determined, as we all know, by the atmospheric air pressure. At sea level water boils at 100°C, but on Mount Everest's peak it starts boiling at 68°C.



The **Zeta** boiler's properties:

- 1 Efficiency**
 - Extremely high efficiency, as well as accessibility and control accuracy.
- 2 Capital cost**
 - Low capital cost in combination with minimal maintenance.
- 3 Steam quality**
 - The boiler's steam quality meets the highest demands.
- 4 Voltage**
 - Feeding voltage can be selected between 6-20 kV for all models.
- 5 Capacity control**
 - Variable capacity control from 0 to 100 percent. Minimum load is 0 percent.

The best solution

The Zeta boiler is certainly the jewel in the crown, but the fact is that we have a product that is even more important, namely to always offer the best solution for each customer – both economically and environmentally. This means that our assignment can include everything from manufacturing, delivery, installation and commissioning, to service, maintenance and training, including peripherals and anything else needed to be able to offer the best solution.

Yes please!

The Zeta boiler is, in other words, a future wise investment that will please the engineer, the financial manager and the environmental manager – and that probably does not happen every day.

Or to put it in another fashion, "Calvados, cognac or whiskey with your coffee?" Answer: "Yes please!"

Figure 2



We offer a full line of boilers, from the smallest to the very largest

The Zeta boiler is equipped with an electrode system and intended for connection to three-phase alternating current. The boiler is guaranteed to never boil dry, because the electric power is cut off automatically if the electrodes are not surrounded by water. (The guarantee follows the laws of physics: It's the water that makes up the boiler's heat-generating resistance.) The supplied energy is converted directly into heat, and the effect in the boiler is controlled by the water level of the electrodes being raised or lowered.

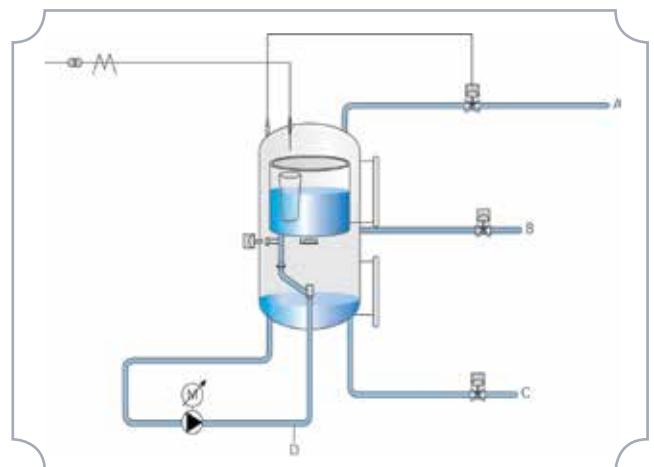
Fixtures

The Zeta electrode boiler (Figure 3) is comprised of an outer pressure vessel (boiler shell) and an inner cylindrical vessel, mounted on brackets or insulators in the shell.

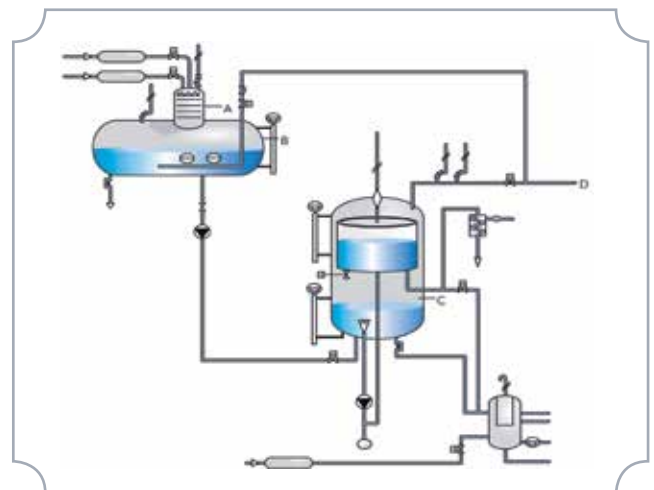
The three-phase electrodes are located in the inner vessel. They are manufactured in a molded material and each electrode is comprised of a number of bar electrodes, which are mounted in a single electrode plate. Each phase electrode is suspended in insulator bushings at the top of the boiler.

The inner vessel, which also forms the electrical system's zero point, divides the boiler into two water compartments (the inner vessel and the outer vessel). At the bottom of the inner vessel there is a control valve; the actuator is mounted on the outside of the boiler.

The circulation pump (supplied as part of the equipment) is connected with the suction pipe to the boiler's outer vessel. The pressure line branches in the boiler into



▲ A = Live steam line, B = Blow down, C = Incoming feed water, D = Circulation circuit



▲ Schematic diagram of the steam plant. A = De-aerator, B = Feed water tank, C = Boiler, D = Live steam line

Clouds do not actually consist of water vapor – which is an invisible gas – they consist of water droplets or ice crystals or a mixture of both.

three pipes, connected to the inner vessel under each phase electrode. The circulation pump is speed controlled and the flow in the circuit varies with the load.

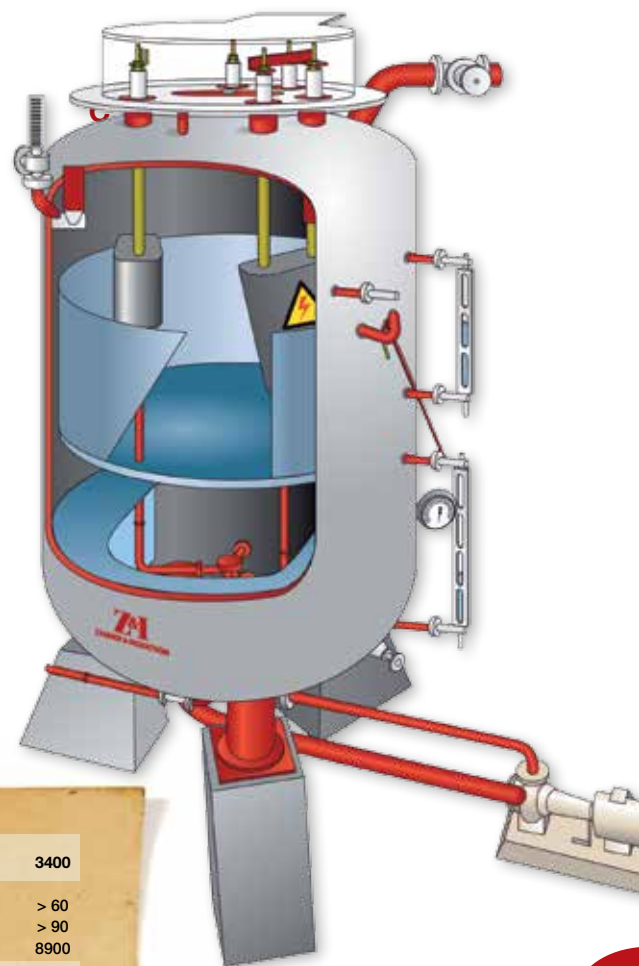
Zeta electrode boilers can be supplied with directly ground zero point, or high- impedance ground zero point. In the latter case, the inner vessel is stripped back from the outer vessel with insulators and all piping connections between the vessel and the outer vessel are made of insulating material. The boiler is thermally insulated with mineral wool covered with aluminum or steel cladding.

Function

An electric boiler installation consists mainly of an electrode boiler and circulation pump, fittings, control equipment, instrumentation and control panels with PLC control. As mentioned above, the electric energy is converted directly into heat energy by electrical current that is passed through the boiler water. Water is an electrical resistance and is heated by the current.

The size of the current passing through the water depends on the electrode’s active surface and the conductivity of the water. The current intensity/power can be eas-

ily adjusted by changing the water level, and hence the electrode’s active surface. The circulating pump moves the boiler water from the outer vessel through the distribution pipes to the inner vessel.



▲ Figure 3. Zeta Electrode steam boiler. A = inner vessel, B = outer vessel, C = electrode

ZDKI/ZDK	2000	2500	2700	3200	3400
Capacity (MW)	0-15	16-20	21-27	28-42	> 60
Capacity (t/h)	0-22,5	24-30	31,5-40,5	42-63	> 90
Height (mm)	6400	6540	6800	8400	8900
Diameter (mm)	2400	2900	3100	3600	4000
Shipping weight (tons)	6,5	11	15	24	32
Pressure test weight (tons)	18	29	37	55	72
<i>General data</i>					
Voltage kV	6-20				
Insulation thickness (mm)	200				
Material dished ends and shell	P295GH				
Control range	0-100 %				
Regulating time min/max (min)	5				
Design pressure	50				
Efficiency	> 99 %				
Max. conductivity (feed water) (uS/cm)	< 5				
Design PED 97/23/EG or ASME					
Standard EN 12953					



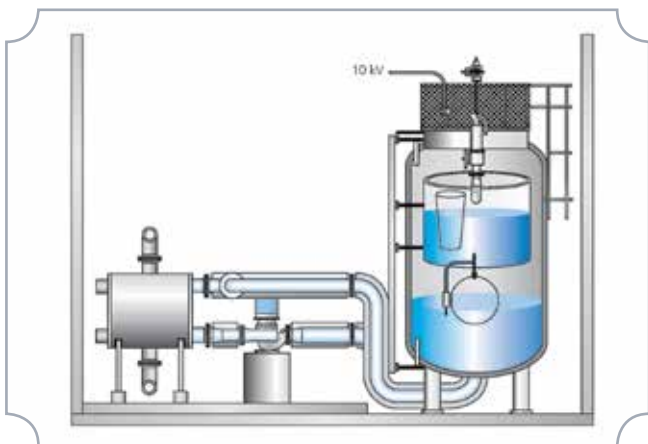


Our range of boilers covers all needs – at least in our solar system

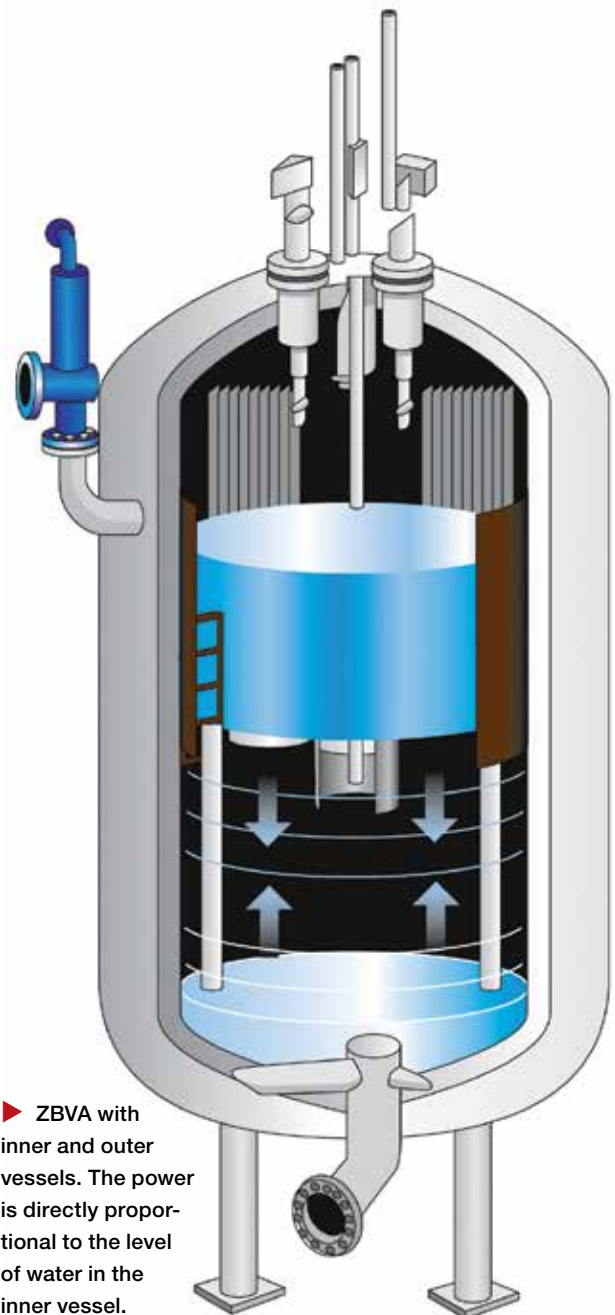
There are two models of Zeta boilers for various customer needs. The ZBVA boiler is based on the same principles as our steam boilers, and consists of an inner and outer vessel. The power output is directly proportional to the level of liquid in the inner vessel.

Since an electric boiler requires a treated water, a water loop is also installed between the boiler and the heat exchanger. The boiler constitutes the water loop's expansion vessel.

This type of boiler can be used when the minimum load must be low and the control speed high. Load range is 0-100 percent, and the boiler can be on stand-by with the main switch on, without taking any power from the high voltage grid. The boiler comes with high-ohmic isolated or directly grounded zero point.



▲ Hot water boiler with circulation pump and heat exchanger.



► ZBVA with inner and outer vessels. The power is directly proportional to the level of water in the inner vessel.



The Grand Prismatic Spring in Yellowstone National Park is the largest hot spring in the United States. The water temperature varies between 63°C and 87°C.

Boiler model ZVPI/ZHPI

When requirements for safety, efficiency and accessibility are particularly high it is a good idea to choose a ZVPI/ZHPI model. These boilers use the same water over and over again in the boiler circuit. The conductivity is constant over time and bottom blows and ventilation is not required.

The boilers have one or two electrodes per phase, depending on size. The water passes through the electrodes and is then heated up. The power is controlled by movable screens that cover the electrode to varying degrees depending on the desired power output. When the electrode is maximally shielded the boiler is in minimum load. The control range is 8-100% of maximum power, and regulating time from minimum to maximum is about three minutes.

► Control cabinet for boiler ZVPI 1808, installed just south of Beijing.



ZVPI/ZVP

	1600	1800	2000	2500	2800
Capacity (MW)	0-5	5-9	10-20	16-24	24-40
Height (mm)	3800	4700	5200	5300	6750
Width (mm)	2140	2600	3250	3250	
Length (mm)	2700	3000	4700	4700	
Diameter pressure vessel including insulation (mm)	1800	2000	2200	2700	3000
Pipe connection	100	150	200	300	400
Shipping weight (tons)	1,5	1,8	2,8	4	8
Pressure test weight (tons)	6,5	10	13	18	30

General data

Voltage kV	6-20
Insulation thickness (mm)	100
Material dished ends and shell	P265GH
Control range	8-100 %
Regulating time min/max (min)	3
Design pressure (bar e)	16
Operating pressure (bar e)	2 till 3
Design temperature °C	204
Maximum operating temperature °C	180
Efficiency	> 99 %
Standard	EN 12953





The art of designing and manufacturing, supplying and installing a boiler system

The heart of the boiler systems that Zander & Ingeström deliver is our pressure vessels and control systems. Everything is manufactured in house and all designs are approved by an accredited independent inspection authority.

The commission routines

Every new commission is firmly rooted in best practices, where we begin with design reviews and establish schedules and specific quality plans.

The actual manufacturing is done with carefully selected suppliers that we in most cases have a longstanding relationship with. There are several reasons why we do not have your own workshop: We get more capacity because we can have several manufacturing units operating at the same time. We keep costs down. And we can locate manufacturing close to you, our customer.

Turnkey

We install complete turnkey plants in Sweden. In other countries, we have contracted partners that tailor installations to suit local conditions.

Commissioning

The moment of truth is at the actual start-up when we test all functions, such as security, functionality and performance.

Service

Once the customer has taken over operation of the plant, we are on hand with different types of service programs.

Replacement parts are always in stock and can be delivered within 24 hours.



Design

Manufacturing

Installation

Commissioning

In 2009, NASA announced that they had found water on the moon. But all the initiated know that Tintin was first. He discovered water on the moon as early as 1953, in "Destination Moon".



1 Customer requirements and our technical expertise

2 Power plant standard Well-known brands

3 Carefully selected representatives around the world

4 Absolute control over the operation





Our suppliers meet the same high quality conditions that we do

Zander & Ingeström boiler systems are quality constructions at all levels and in all functions. We manufacture the core products ourselves, but a delivery includes pumps, instruments, control valves and valves – and some of these products come from other companies.

There is no substantive difference, because we demand the same high standards of our suppliers that we do of ourselves. Or to put it more concretely: When we assess a supplier, we control product quality, reliability and technical expertise, as well as the code of conduct and service,

while the price comes last on our specifications. To make this even more concrete: We only work with well-known brands, and all the components in every delivery are of good power plant standard. See the examples below.

Asia and Europe

For transportation and environmental reasons, we manufacture bulky and heavy products as close to our customers as possible. So we manufacture pressure vessels in both Asia and Europe.

Kvalitetsexempel

- 1 Cirkulationspumpar av god industristandard
- 2 Cirkulationspumpar i API-utförande
- 3 Värmeväxlare försedd med packningar, alternativt i helsvetsat utförande
- 4 Luftdrivna ställdon med positioner borgar för snabb och noggrann reglering



Breathtaking Iguazu Falls, on the border between Brazil and Argentina, consists of 275 different waterfalls. Close to two million gallons of water passes over Iguazu Falls every second.



▲ An operator panel is used to run the plant locally. It is connected via, for example Profibus, to the master control system.

In addition to our formal certificates we see each commission as a new certification



That Zander & Ingeström is the world's leading supplier of electric heat and steam boilers, as well as all kinds of industrial pumps, is something that we daily prove in practice. But in addition, we naturally also fulfill various formal competence criteria.

ISO 9001:2008

ISO 9001 is an internationally recognized seal of quality that the company in question is to be trusted across the board: in the internal work, the relationship with customers and, of course, in terms of delivered products and services. It also means that we are constantly working to further improve the quality of our company's management system.

Environmental Policy

Zander & Ingeström's environmental program is our commitment to take an active responsibility for how every part

our business affects the environment: be it manufacturing, transportation and installation, operation, maintenance, repair or disposal of our products. We are not content with just surpassing current environmental laws and regulations – we are continually working to get even better. Since the environment is a shared responsibility, we impose strict requirements on our principals and suppliers.

Trace Code of Conduct

Zander & Ingeström has also committed itself to the Trace Code of Conduct, which implies an absolute requirement to comply with all laws and regulations (even in lawless countries), as well as an absolute prohibition of bribery and improper gifts and services. We are also required to avoid any relationship that is commercially inappropriate or in any way unsound. A membership in Trace obligates: Violation of the rules will lead to immediate expulsion.

In short, the Trace Code of Conduct is good old decency with a new twist.



Both are beautiful, but sunsets are redder than sunrises, because the atmosphere contains more particles after the day's activity than after the night's rest.



◀ ISO 9001:2008 means, in short, that the holder is a company you can trust.

▶ Naturally, Zander & Ingeström is a financially stable company with high credit ratings.





▲ At Zander & Ingeström's headquarters in Täby, north of Stockholm, we have twenty-five employees. Around the world, our partners and affiliates employ an additional twenty-five. Though globally dispersed, we form a closely-knit group that has worked together for many years developing know-how, experience and a great loyalty to our customers – and thus also to our own business. No one could wish for a better foundation to build on for the future.

Fog occurs when the air is so saturated with microscopic water droplets that visibility is less than one kilometer.
(No poet has been involved in the writing of this description.)



► Inspired by the opportunities that the steam turbine opened up, Bengt Ingeström and Oskar Zander founded the engineering firm Zander & Ingeström back in 1898.

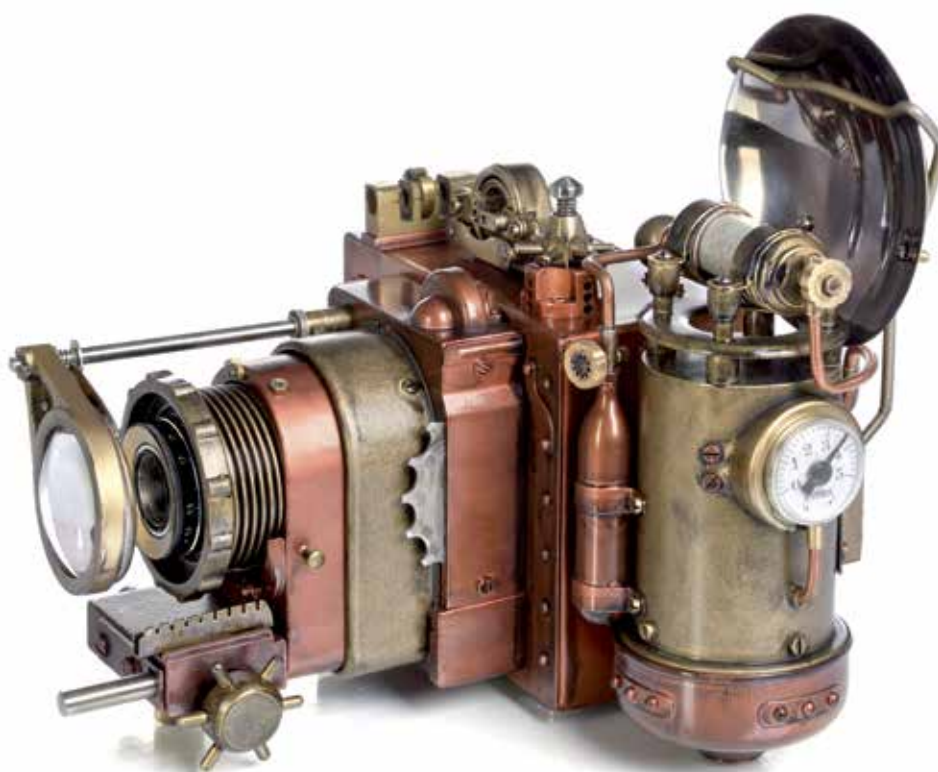


Swedish technological and industrial history has several prominent figures that through talent, strong vision and hard work laid the foundations of the modern welfare society that many today take for granted. One of these figures was Bengt Ingeström. He saw a glorious future in steam turbines, and together with his colleague Oskar Zander he started the engineering firm Zander & Ingeström. The year was 1898.

The young company marketed steam turbines and centrifugal pumps. With a nose for market needs and technologies, Zander & Ingeström developed new products while the business grew and conquered more areas. And the same kind of innovative work and dedication has continued through the years.

Today, Zander & Ingeström has a leading position in the global market – largely thanks to the legacy of Bengt Ingeström. Dedication, work satisfaction and optimism live on in today's close-knit group of employees.





While waiting for someone to invent the steam camera, we take joy in the steam boiler, that does a lot of good around the world, when it replaces fossil fuel combustion by converting excess electricity to heat/steam for district heating and industries.

Zander & Ingeström
Box 7206 · SE-187 13 Täby
Street address: Tillverkarvägen 11
Tel +46 8 80 90 00
E-mail zander.ingestrom@zeta.se
Home page www.zeta.se