Sterling Deaerator Company

Engineering • Design • Fabrication

Sterling Deaerator Company has become one of the leading worldwide suppliers of Deaerators, Continuous Blowdown Equipment, Heat Transfer Fluid Expansion Vessels, Package Deaerators and Steam Accumulators since its inception in 1987. We pride ourselves in our ability to compete on deaerator projects of all sizes, ranging from small scrubber type units to the largest central station utility units.

Sterling prides itself even more on our long list of satisfied customers, who buy repeatedly from Sterling and include some of the largest companies in the world.

Our client list includes a large number of the major deaerator purchasers worldwide. A few examples are: Southern Company, Siemens, JGC, American Electric Power, Consolidated Edison, Toshiba, Hyundai, Mitsubishi, Black and Veatch, Bechtel and others too numerous to mention. Sterling has alliances with fabricators worldwide, which makes us competitive virtually everywhere around the globe, while maintaining the highest quality.

Sterling has the ability to handle even the largest projects efficiently from start to finish, including Engineering, Drafting, Design, Fabrication and Quality Assurance.

Company History

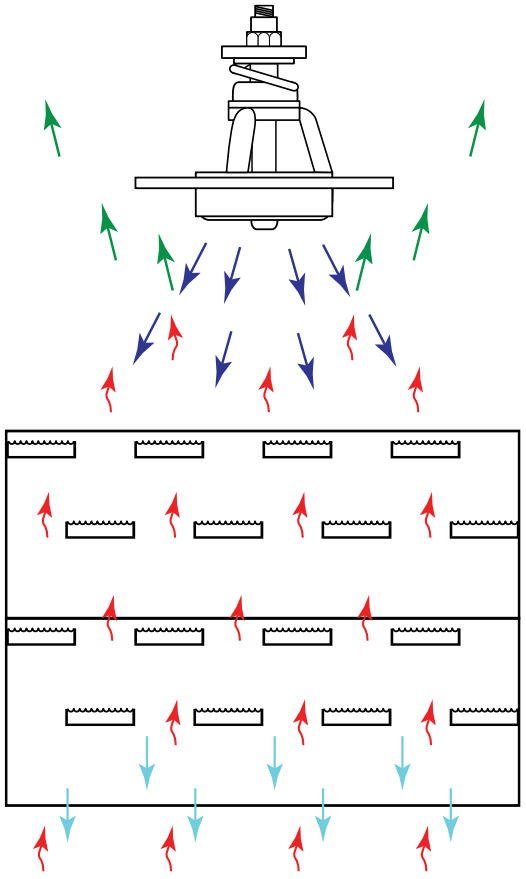
Sterling Deaerator Company began operations in 1987 in Lenexa, Kansas. The company founder, Mr. Al Sidun, had been President of Chicago Heater Company for many years prior to starting Sterling. Mr. Sidun formed Sterling with a select group of experienced engineering, drafting, sales and service personnel. Since its inception, Sterling has continuously improved all areas of operation with a strong emphasis on customer satisfaction. Sterling has gained vast experience in all applications, serving Power Generation, Cogeneration, Pulp and Paper, Petro-Chemical, Light Industrial and other industries. Sterling is a leading provider of its range of equipment worldwide. Sterling has a global network of representatives and trading partners to facilitate international markets.

The Deaerating Principle

The removal of dissolved gases from boiler feedwater is an essential process in a steam system. The presence of dissolved oxygen in feedwater causes rapid localized corrosion in boiler tubes. Carbon dioxide will dissolve in water, resulting in low pH levels and the production of corrosive carbonic acid. Low pH levels in feedwater cause severe acid attack throughout the boiler system. While dissolved gases and low pH levels in the feedwater can be controlled or removed by the addition of chemicals, it is more economical and thermally efficient to remove these gases mechanically. This mechanical process is known as deaeration and will increase the life of a steam system dramatically.

Deaeration is based on two scientific principles. The first principle can be described by Henry's Law. Henry's Law asserts that gas solubility in a solution decreases as the gas partial pressure above the solution decreases. The second scientific principle that governs deaeration is the relationship between gas solubility and temperature. Easily explained, gas solubility in a solution decreases as the temperature of the solution rises and approaches saturation temperature. A deaerator utilizes both of these natural processes to remove dissolved oxygen, carbon dioxide and other non-condensible gases from boiler feedwater. The feedwater is sprayed in thin films into a steam atmosphere allowing it to become quickly heated to saturation. Spraying feedwater in thin films increases the surface area of the liquid in contact with the steam, which results in more rapid oxygen removal and lower gas concentrations. This process reduces the solubility of all dissolved gases and removes them from the feedwater. The liberated gases are then vented from the deaerator.

With these principles in mind, Sterling Deaerator Company employs a counter-flow two-stage system of heating and deaerating feedwater. This system reduces dissolved oxygen concentration to less than 0.005 cc/liter (7 ppb) and completely eliminates the carbon dioxide concentration.



Undeaerated Water
Non-Condensibles (Vented)
Steam
Deaerated Water

Technical Advantages

Sterling values the feedback from our customers. When maintenance personnel required easier access to the spray/tray type deaerator internals, Sterling improved the design. The water distribution system design now utilized by Sterling is a header-style spray pipe with spray valves installed throughout the pipes. Utilizing the header-style spray system allows more room for maintenance to access the spray valves and vent condenser. Some older vent condenser designs proliferated high thermal stresses in the vent pipes and their connections to the waterbox causing vent pipes to crack or loosen at the weld joint. Sterling's header style design has eliminated this problem and also allows easy access to the vent pipe for inspection. The header style design removes the vent pipe from the water box and allows the vent to be further removed from thermal stress, thus decreasing wear.

Retrofit Dual Cone Spray Valves

The header-style spray pipe offers several more advantages besides those for maintenance. One important advantage is the position of the spray valves. Sterling designs the spray pattern for the most efficient deaeration by graphically laying out the spray valves for each deaerator. The position of the valves underneath the header also prevents valve chatter during low flows because water flows parallel to the spray valve axis.

Sterling has also improved the spray valve mounting system. The spray valves are mounted with bolts rather than studs. Previously, when stainless steel studs had their threads stripped or damaged, replacement was difficult and time-consuming. Once again, Sterling listened to customer input and changed the design. Now maintenance personnel can quickly and easily replace a bolt rather than cutting and welding on a new stud.

Research & Development

Continuously seeking to improve our product, Sterling has ongoing Research and Development efforts which have led to improvements in reliability and efficiency and have resulted in issuance of patents. Commitment to maintaining a focus on the latest technology is Sterling's pledge to its customers. Our highly skilled engineering staff continues to search for new and more efficient designs, which will secure Sterling's place as a world leader in deaeration equipment.

Engineering

Sterling has a design staff with over a century of experience to offer customers the most economical solution for each application. Through the aid of custom designed software, Sterling can respond quickly to customer inquiries and match the customer's needs with Sterling's proven technology. Sterling remains an active member of the Heat Exchange Institute (HEI) and continues to work in developing design standards for deaerators through HEI. We have offices in Missouri and Georgia, which help us to meet customer needs within the United States and worldwide. Sterling is also active in the ASME and played a crucial role in the rewriting of ASME Performance Test Code Section 12.3. PTC 12.3 is the most widely accepted code for deaerator performance testing.

Drafting

Sterling's drafting department uses the latest AutoCAD® software to produce quality drawings in a timely fashion. Our experienced drafting department works extensively with the customer to produce drawings providing the most efficient and economical solutions to our customers' needs. Drawings are produced, then checked by at least one other drafter and an engineer before they are submitted. Our drawings are printed using the latest laser plotting technology for clear, sharp originals and blueprints. We have experience working with many customer's online collaboration systems, as well as FTP and other electronic means. Full size plottings and prints are also available.

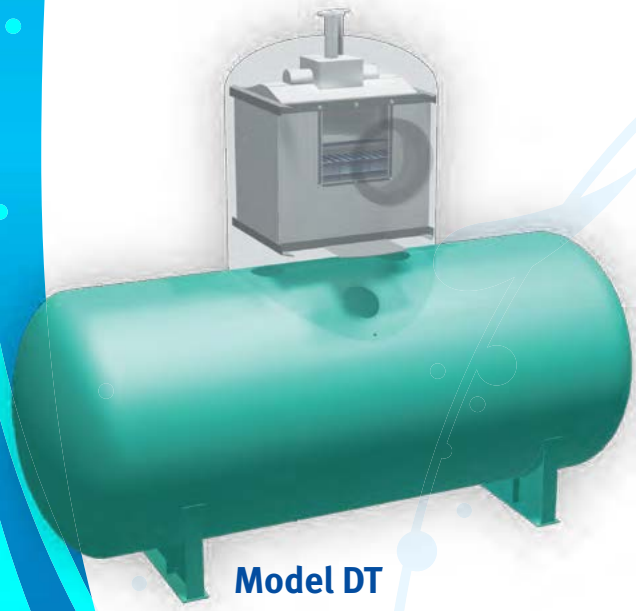
Sterling Deaerator Models

Model HT

Horizontal type with no storage capacity
Spray/tray technology

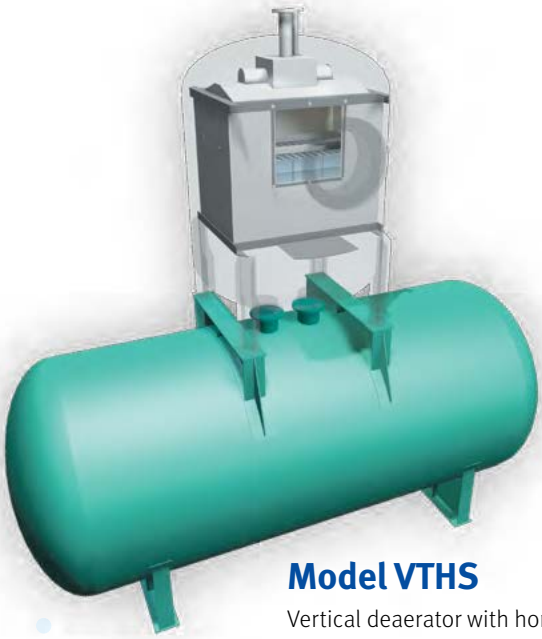
Model VT

Vertical type with no storage capacity
Spray/tray technology



Model DT

Dome type with horizontal storage
Spray/tray technology

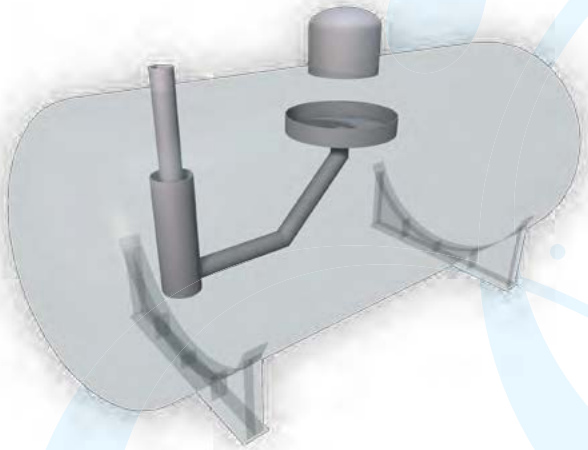


Model VTHS

Vertical deaerator with horizontal storage
Spray/tray technology

Model HTHS

Horizontal deaerator with horizontal storage
Spray/tray technology

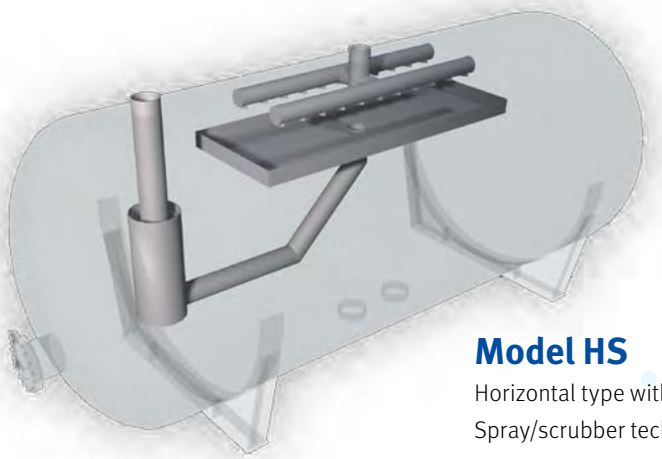


Model DS

Dome type with integral, horizontal storage
Spray/scrubber technology

Model UT

Upright with integral storage
Spray/tray technology



Model HS

Horizontal type with integral horizontal storage capacity
Spray/scrubber technology

Spray Valves

Sterling utilizes two designs of its unparalleled spray valve for maximum dissolved gas removal, using the standard single cone for normal operation and the patented (US Patent # 5,862,992) Dual Cone High Efficiency Spray Valve in difficult applications. The Sterling Spray Valve is cast from rugged, non-corrosive type 316L stainless steel to ensure maximum life. This self-adjusting spray valve can handle flow up to twice its rated capacity, while maintaining an effective, consistent spray pattern. Because the Sterling Spray Valve is hydraulically balanced and non-guided, solid particles and debris pass harmlessly through the valve without clogging or reducing performance. As described in the Deaerating Principle, the thin film of feedwater sprayed into the steam atmosphere provides rapid heat transfer and gas removal. The Sterling Spray Valve produces that essential thin cone of feedwater consistently over its operating range, resulting in continuous deaerating performance.

Dual Cone High Efficiency Spray Valve

Standard Single Cone Spray Valve

Sterling's Dual Cone Spray Valve adds a second, slightly smaller, cone of feedwater which produces a 71% increase in steam to water surface contact area within the deaerator's spray zone. The Dual Cone Spray Valve is best suited for installation in existing deaerators to increase performance and reduce chemical costs. Upgrading is especially beneficial for customers with underperforming deaerators. The Dual Cone Spray Valve is a direct replacement for Sterling's standard single cone design, as well as most of our competitors' spray valves, making it ideal for retrofit applications. Sterling also offers mounting adaptors for conversion from some competitors' older designs to the Dual Cone's bolting pattern.

Tray Assembly

In addition to Sterling's superior spray valve, our tray type deaerators are also equipped with the Sterling Tray Assembly. The Sterling Tray Assembly is constructed of 16 gauge, type 430 stainless steel and is fastened in one of two ways, with stainless steel rivets or sturdy interlocking stainless steel clips. Each tray assembly consists of two staggered rows of four tray channels. This staggered tray channel pattern ensures maximum feedwater retention and reduced pressure drop which results in optimum heating surface and deaeration. The Sterling Tray Assembly, as well as the Sterling Spray Valve, is designed to be resilient: able to withstand upset and extreme conditions resulting in reduced downtime. Rugged construction combined with lower steam pressure drop extends deaerator life even under the most severe operating conditions. Sterling also offers trays for no longer existent companies, such as L.A. Water Treatment. Sterling can replace most competitors' trays.

Replacement for LA Water Treatment Tray

Riveted Tray

Serrated Edge High Efficiency Tray

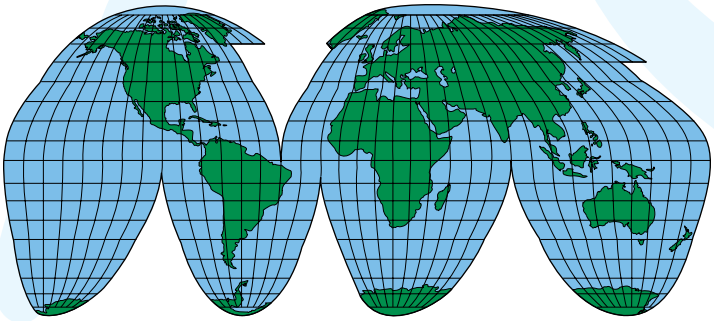
PermaLock Tray

HTF Expansion Vessels

Heat Transfer Fluid (HTF) Expansion Vessels are component parts of a solar power plant and are designed to hold the HTF, which transfers energy from solar collector arrays (SCA's) to steam generators.

These vessels undergo extreme thermal cycling in their daily operation. The vessels begin to warm up at sunrise as energy becomes available and quickly reach maximum operating temperatures and remain there until the solar energy starts to fade and the vessels cool off. Shorter, less severe, thermal cycles also occur during the day when passing clouds partially obscure the sun and reduce the amount of solar radiation available. This thermal cycling results in stresses being induced, then reduced on a frequent basis.

Sterling, applying its vast deaerator experience, kept this fact in mind when designing the features of the Sterling Expansion Vessels. Past vessel designs have suffered serious failures when the nature of this thermal cycling was not adequately considered. Sterling applies Finite Element Analysis techniques to both the vessel and accompanying saddle designs in order to reduce thermally induced stresses and the subsequent failures that result.



Fabrication

Sterling subcontracts pressure vessel fabrication as do most deaerator suppliers. Fabrication facilities are prequalified by Sterling and must meet ASME Codes and Standards as well as Sterling's own stringent requirements. Sterling utilizes fabrication facilities around the globe and continues to explore new facilities in order to compete in today's global market. In addition, Sterling has a sister company which specializes in fabrication of deaerator internal components and boiler feed systems. This helps ensure that the components which are critical to performance are manufactured to the highest standards.

Quality Assurance

Quality Assurance procedures followed by Sterling assure that products meet our customer's most exacting specifications, which may include:

- ASME Section VIII and Section I
- Heat Exchange Institute
- American Petroleum Institute

Non-Destructive Testing Capabilities Include:

- Radiography
- Wet Fluorescent Magnetic Particle Testing
- Post Weld Heat Treatment
- Positive Material Identification
- Ultrasonic Testing
- Dye Penetrant Testing
- Hydro Testing

Sterling inspectors work closely with customers, fabricators and third party inspectors to verify that all necessary standards are met.

Packaged Deaerators/Boiler Feed Systems

A significant part of Sterling's business includes the supply of package type deaerators. These products come with a support stand for the deaerator, including pumps, piping, valves, strainers and control systems. By purchasing a complete package unit, the customer has assurance of total boiler feedwater system performance, as well as a single point of responsibility.

Accessories

In order to obtain optimum performance, Sterling can provide accessories established by specification; or recommend an application with quality engineering, efficient design, dependability, safety and cost in mind. By use of reputable, service-oriented, accessory manufacturers for the customer's special requirements, Sterling can address demands made by today's power and process industries.

A standard list of accessories might include:

- Safety Relief Valves
- Vacuum Breakers
- Level Gauges, Switches & Transmitters
- Pressure Gauges
- Thermometers
- Vent Valves
- Overflow Control Valves
- Inlet Control Valves
- Steam Inlet Control Valves
- Many other specific job needs

Blowdown Tanks

Even with the best pretreatment programs, boiler feedwater will contain some degree of impurities, such as suspended and dissolved solids. These impurities can accumulate inside the boiler over time. The increasing concentration of dissolved solids may lead to carryover of boiler water into the steam, causing damage to piping, steam traps and even process equipment. The increasing concentration of suspended solids can form sludge, which impairs boiler efficiency and heat transfer capability.

To avoid boiler problems, water must be periodically discharged or "blown down" from the boiler to control the concentrations of suspended and total dissolved solids in the boiler.

Sterling's Blowdown Tank receives blowdown from the steam drum and steam generator. Sterling's Blowdown Tank can also function as a gravity feed drain for the steam generator when the generator is drained for maintenance.

In Sterling's design, flashing water enters the tank tangentially where centrifugal action separates the liquid from vapor. Flashed steam exits through a nozzle in the top of the tank, while the liquid is drawn from the bottom of the vessel.

Blowdown Heat Recovery Systems

All steam boilers must be blown down to reduce the amount of total dissolved solids in the boiler water. However, along with the solids, thermal energy is lost. Sterling's Blowdown Heat Recovery System can recover up to 90% of the heat energy that would otherwise be wasted. The recovered heat is used to pre-heat boiler make-up water before it enters the deaerator and for low pressure steam to heat water inside the deaerator, which reduces the cost to run the deaerator and improves overall boiler efficiency.

Reducing the temperature of the blowdown before its disposal is a typical Code requirement. Therefore, a heat recovery system also eliminates the need to dilute blowdown with cold water before its disposal.

Sterling's Blowdown Heat Recovery System offers an attractive payback, depending on blowdown volume. Several boilers can be connected to a single heat recovery unit, reducing capital costs. Typical payback is under 12 months.

Steam Accumulators

Economic steam generation is a requirement in today's industry. Commonly, steam generators are over-designed to account for the peak process steam demand. This capital expenditure can be high if the peak demand is large in comparison to the average load. Occasionally, it is economical to design the steam generator for average steam demand and utilize a steam accumulator.

The Sterling Accumulator is designed to reduce the maximum boiler load while still meeting peak steam requirements. This is accomplished by operating the boiler at a constant rate and storing the generated steam in an accumulator until needed. Since steam is continually being charged to the accumulator, boiler load variation is diminished. Reduced load variation reduces moisture carryover into the steam system and increases generation efficiency. Operating at a near constant load also reduces the amount of maintenance required for all boiler components.

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