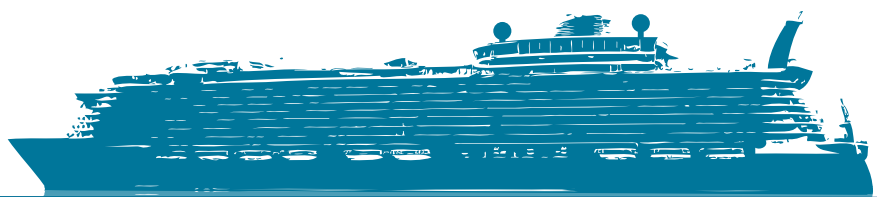




HEAT MANAGEMENT

Creating value with infrasound™



SONIC SOOT CLEANING SYSTEM

Reducing soot build-up on economizers, boilers and ducts

By harnessing the power of infrasound, Infracone offers soot cleaning solutions that reduce soot build-up on economizers, boilers, catalysts and ducts. In this way the usage of steam soot blowers is reduced or eliminated, the life time of heat exchangers prolonged, and the appearance of soot on deck reduced drastically.

This is Infracone

Our driving force is to help our customers to optimize the soot cleaning solution onboard vessels in order to make it as simple, effective and efficient as possible.

We aim to be the trusted partner of choice for our customers by focusing on a high return on investment in our projects.

We are passionate about pioneering the infrasound soot cleaning technology. We carried out our first marine installation in 1982. The objective of that project was to prevent soot accumulation in a boiler onboard M/S Rimula, a steamship. The success of that installation taught us about the power of infrasound. The experience obtained over the intervening years has taught us how to create value for our customers with infrasound.

Different applications and vessels

Over the past decades we have reduced soot build-up in different applications like economizers, oil-fired boilers, incinerators, catalysts and ducts. We have collaborated with a vast number of ship owners with different commercial activities, like cruise vessels, ferries, cargo vessels and FPSO's.



Customer benefits

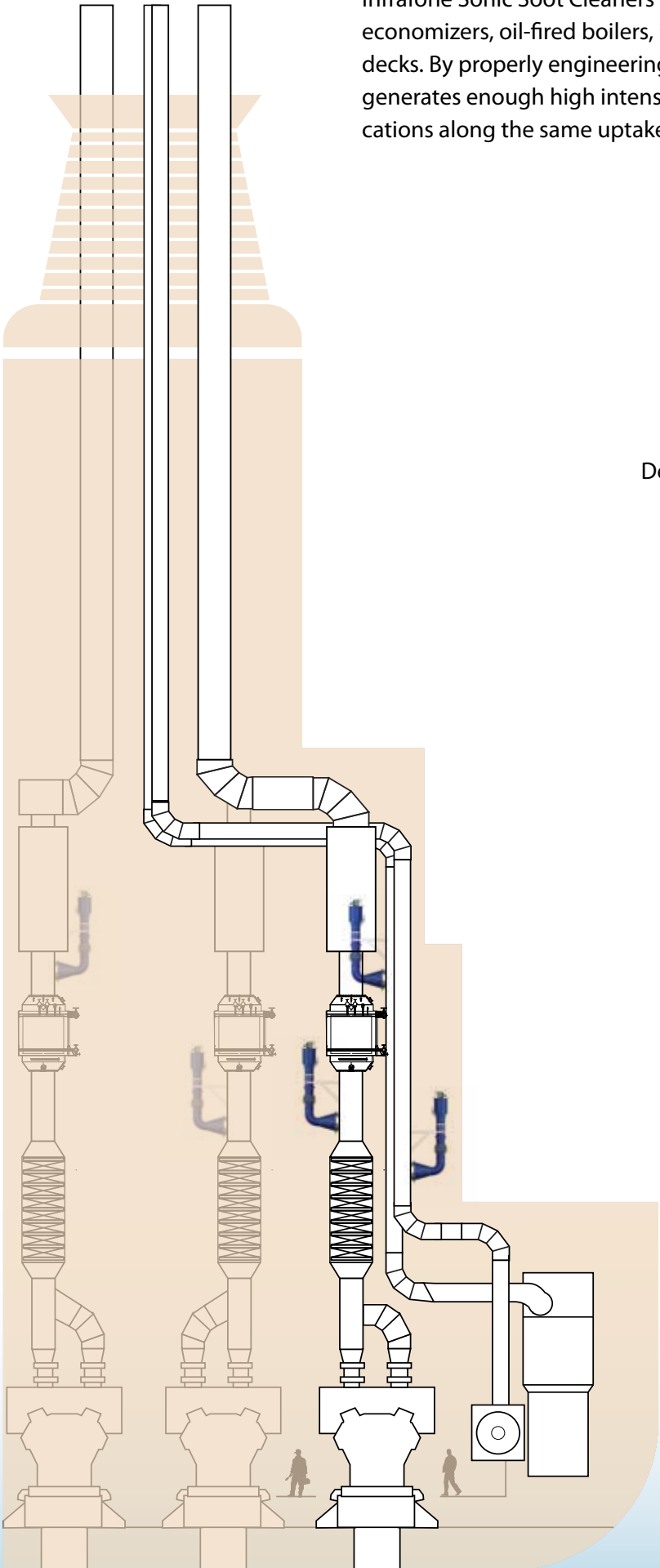
Infrasound is a non-abrasive, cost-effective way of preventing soot accumulation.

By operating automatically and continuously, it reduces or even eliminates the usage of traditional steam soot blowers and the frequency of manual water-washing.

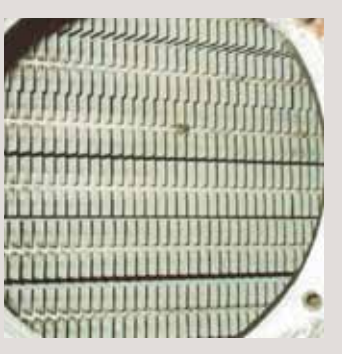
Our expertise in this field has brought our customers numerous benefits such as:

- **Reduced soot appearance on deck.** This brings three benefits, firstly equipment or goods damage on deck is reduced, secondly the man-power hours for manual cleaning of the deck is reduced and thirdly the cruise ships passengers comfort is increased while their complaints due to soot appearance are reduced.
- **Reduced risk of soot fires.** This leads to a risk reduction of serious economizer and duct damage and the consequent risk reduction of production outage.
- **Increased economizer efficiency.** Cleaner heat transfer surfaces and the reduction or elimination of steam soot blowing means that more heat is converted into useful energy.
- **Increased lifetime of the economizer, boiler and catalyst and reduced maintenance costs.** The usage reduction or elimination of steam soot blowing prevents erosion and corrosion of boiler/economizer/catalyst parts.
- **Lower peak smoke density.** As the Sonic Soot Cleaners operate with a cycle time of a couple of minutes, the amount of soot released everytime is very small and does not result in a peak of visible soot from the stack.
- **Reduced costs of water disposal.** By reducing the frequency of manual waterwashing, the amount of sludge water is reduced.

Infracone Sonic Soot Cleaners reduce soot build-up in different applications like economizers, oil-fired boilers, incinerators, catalysts, ducts and consequently decks. By properly engineering the power of infrasound, one sonic soot cleaner generates enough high intensity low frequency sound to clean different applications along the same uptake like an economizer and a catalyst.



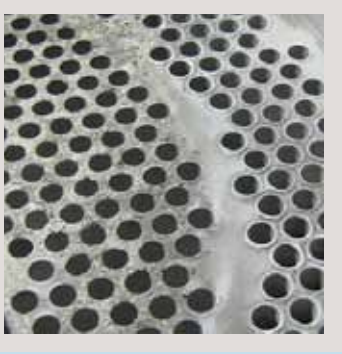
Deck and funnel top



Economizer

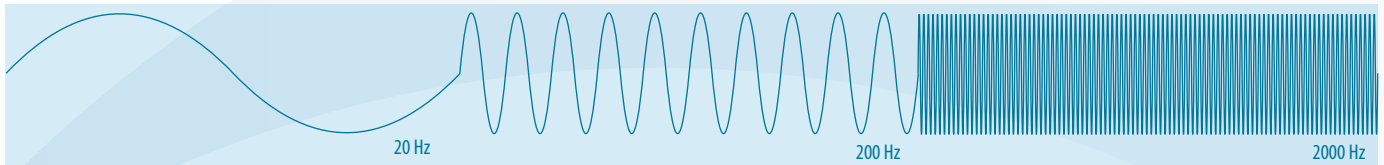


Catalyst



Oil Fired Boiler

Sonic Soot Cleaning System



When engineering and designing our system, three terms are crucial: optimization of infrasound power, user-friendliness and low operational and maintenance costs."

Optimization of infrasound power

Our technology is based on taking advantage of the properties of infrasound, since our system operates within a frequency range from 15 Hz to 30 Hz.

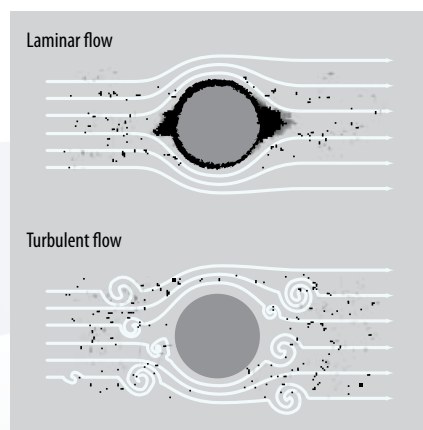
Sound can be divided into infrasound, audible sound and ultrasound. The sound properties differ substantially depending on the frequency range.

Infrasound is suitable for soot cleaning applications because of several reasons. It reaches areas far away from the acoustic source, unlike conventional soot cleaning methods or even audible sound cleaning methods. It spreads in all directions with the same intensity, and the energy losses of infrasound across the space are rather low. In short, **this means that even boilers with big cross-sectional areas, boilers with compact tube bundles or even finned-tube bundles**

are suitable applications for our technology, as the energy of infrasound will reach far, and will affect even the innermost areas.

Besides, space constraints for the installation of the system are seldom an obstacle due to the flexibility that the infrasound properties give us.

The infrasound energy, when properly engineered and applied, causes oscillations within the flue gas flow. The turbulence created by the oscillations prevents accumulation of soot deposits on heat exchange surfaces.



User-friendliness

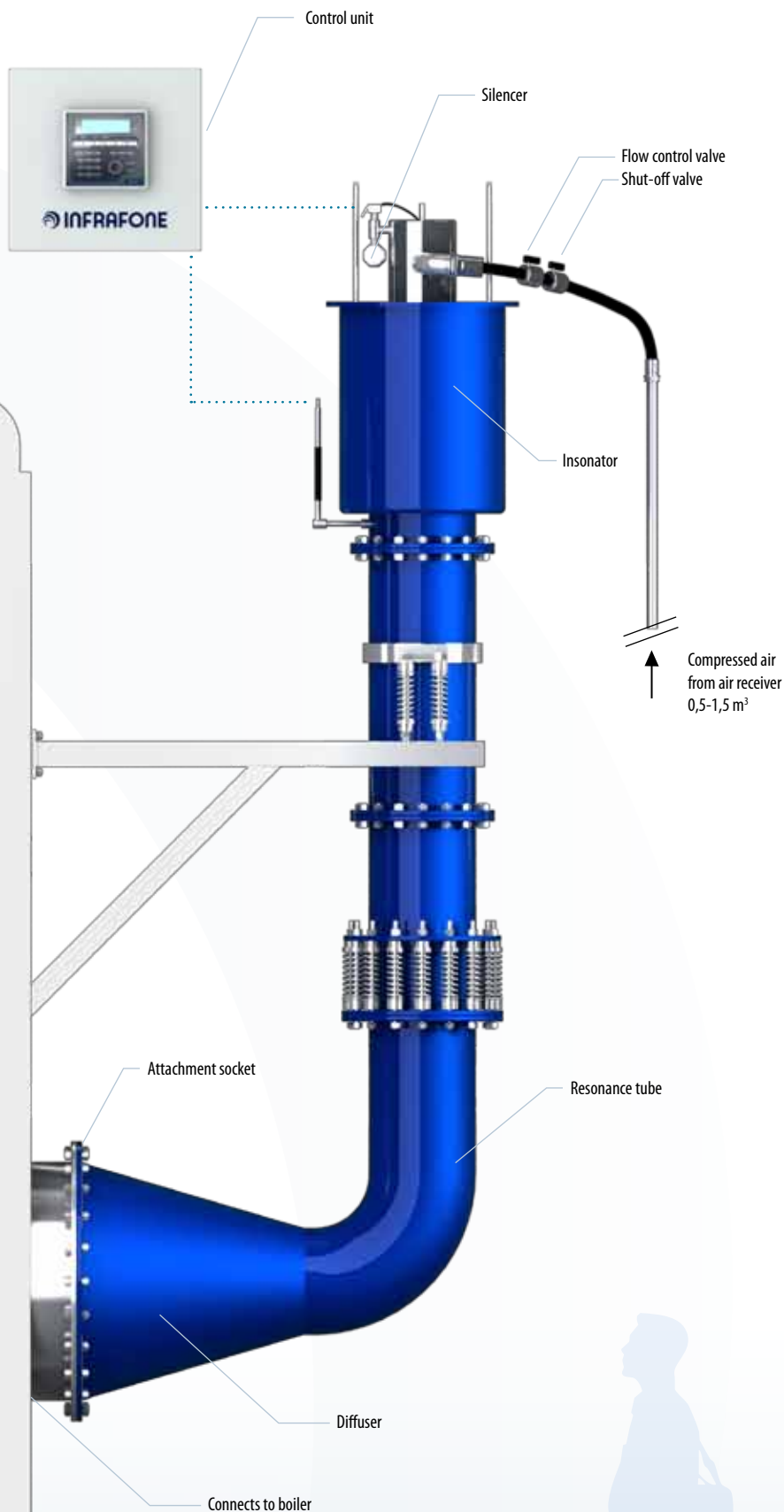
With the end-user in mind, we have transformed advanced knowledge and engineering into simple operation. Infracone's Sonic Soot clean-

ing System is a dry, automatic and continuous cleaning system. This means that it operates automatically with high mechanical reliability.



Low operational and maintenance costs

Our focus on cost-effective solutions means that our customers achieve high value at low operational and maintenance costs. Our system is operated by compressed air, and the mechanical design allows high acoustic power with low air consumption. The Sonic Soot Cleaners have only one moving part, the piston-spring system, which minimizes the maintenance costs.



System operation

The Infrafone Sonic Soot Cleaner works in one to minute cycles, insonating (generating short sound blasts) for just one to four seconds, as long as the boiler is running. It is operated by Compressed air at 5 to 8 bar (70 to 115 psi).

The insonating and cycle time are regulated by a control unit, which also measures the sound pressure generated.

The main parts of the Sonic Soot Cleaner are the Insonator, which is the heart of the system, the Resonance tube, and the Diffuser.

The Insonator is fed with compressed air, which is then converted into infrasound waves. This conversion is controlled by a patented system.

The powerful infrasound waves are then transferred into the flue gas flow, building up a sound pattern that prevents soot build-up in the targeted area of the boiler.

The Sonic Soot Cleaner is equipped with a vibration damper, which reduces structure-borne sound.

Ensuring customer satisfaction

We aim to establish long term beneficial relationships with our customers.

We work together with them all the way from the first meeting where we establish a clear picture of their needs to the performance evaluation meeting, where we review meeting those needs.



Our knowledge

Generating infrasound is not enough to obtain the desired cleaning effect. You need to know how to take advantage of it. Our continuous development has ultimately led to unique acoustic modeling software which simulates the behavior of infrasound waves in the customer's application and calculates the optimal installation location and parameter settings of each unit. Therefore every Sonic Cleaner is tailor-made for each specific application.

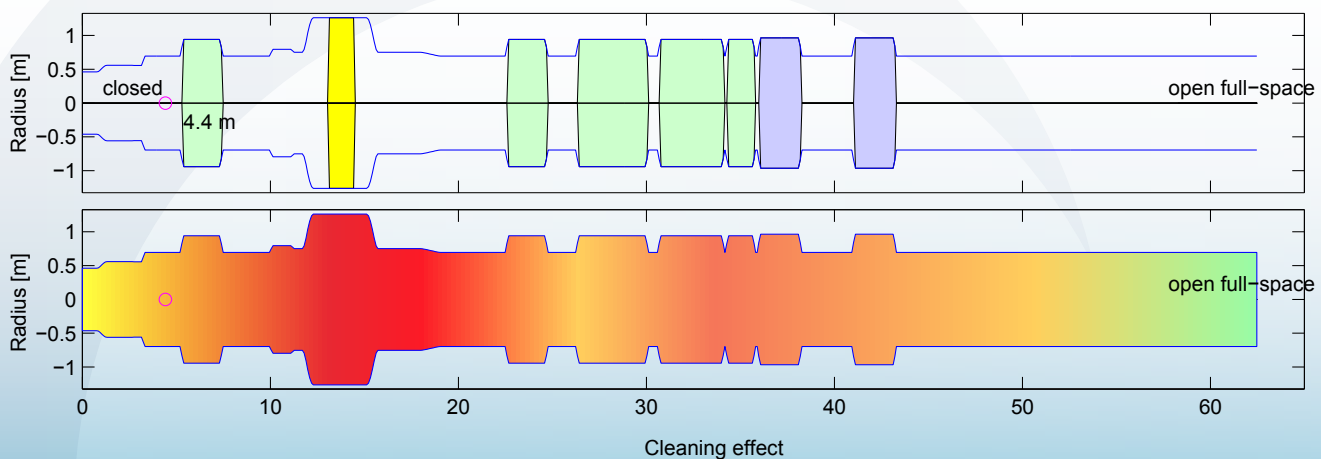
Our quality

We believe that our customers define quality. Customers buy on perceived value, measuring benefits against costs and selecting a product that provides superior value in a cost effective way. That is why, to us, quality means to delivering products and services that address our customer needs and live up to their expectations regarding high return on investment, functionality, reliability, in-time delivery, environmental friendliness and excellent service.

Our team

Being experts in infrasound soot cleaning is not enough. Understanding our customer's business and challenges is at least as important. Our team has a deep knowledge in sonic cleaning and a wide experience in helping shipowners to optimize the soot cleaning solution onboard vessels.

We work together with our customers, every step of the way, to ensure that the process moves smoothly forward.



Marine references

Crusie vessels & ferries

AIDAaura	Dawn Princess	MSC Divina	Royal Princess
AIDAvita	Diamond Princess	MSC Preziosa	Ruby Princess
Allure of the Seas	Disney Magic	Navigator of the Seas	Sapphire Princess
Artania	Emerald Princess	MY Dubai	Sea Princess
Azura	Fram Hurtigruten	Oasis of the Seas	Star Princess
Carnival Britannia	Golden Princess	Octopus	Ventura
Caribbean Princess	Grand Princess	Queen Mary II	Voyager of the Seas
Coral Princess	Independence of the Seas	Regal Princess	
Crown Princess	Majestic Princess	Romantika	

Cargo vessels

Al Salheia	Asian Progress III	MOL QUALITY	Trader
APL China	Asian Progress IV	MOL QUARTZ	Transporter
APL Garnet	Carrier	MOL QUASAR	Viking Amber
APL Jade	Don Juan	MOL QUEST	Viking Coral
APL Japan	Don Quijote	MOL QUINTET	Viking Diamond
APL MERLION	Express	MSC Natalia	Viking Ocean
APL Raffels	Falstaff	Oriental Jade	Viking Sea
APL Sardonyx	Grande Argentina	Ortviken	Viking Conquest
APL SENTOSA	Independence II	Otowan	Viking Destiny
APL Spinel	Kallio	Petrobras 33	Yacht Express
APL Temasek	Kashimasan	Sea Hellinis	Yufusan
APL Vanda	Katsuragisan	Shipper	