


Vapor Infusion

A simple, cost-effective solution to reduce and remediate fouling



Vapor infusion is an environmentally friendly alternative that reduces fouling and protects heat exchangers and process equipment that use water as a process stream. It safely generates scrubbing, transitory macro-, micro-, and nanobubbles to reduce the formation of foulants on heat exchanger surfaces while imparting targeted and reduced chemical treatments.

How Vapor Infusion Works

The vapor infusion system injects (infuses) vaporous treatment into the water flow stream of heat exchangers and process equipment, thus creating a profusion of macro-, micro-, and nanobubbles. These bubbles mechanically prevent and chemically reduce fouling on internal surfaces of heat exchangers and process equipment using a three-pronged approach. First, chemical treatment prevents biofouling and scaling. Second, macro/microbubbles sweep sediments and large foulant residue away. Third, nanobubbles begin clustering scaling nanoparticles, thereby increasing the solubility of the fouling species in the solution and resulting in the dissolution of bulk scaling precipitants. The clustered nanoparticles are then carried away with the flow stream.

Vapor infusion bubbles have a low oxygen, chemically treated vapor core that includes an aqueous reactive surface, which

- requires less chemical treatment
- mechanically prevents fouling formation
- inhibits scaling
- reduces corrosion sites and sedimentation
- improves heat exchanger efficiency
- works during process operation (unlike cleaning in place, teardown, and other cleaning protocols)

HTRI[®]

Environmentally Friendly Technology for Heat Exchanger Applications Using Water as a Coolant

Vapor infusion is effective for applications that use fresh water, sea water, or water with high levels of scaling salt. Vapor infusion has successfully been implemented on plate-and-frame and shell-and-tube heat exchangers, as well as evaporators and scrubbers.

The benefits of our vapor infusion system have been demonstrated in studies conducted at various universities, commercial applications, and with the United States Navy. Positive results include

- dramatic reduction in fouling activity
- reduced environmental impact from heat exchanger fouling
- increased time between cleanings
- negligible levels of residual chemical in treated water
- significant decrease in need for heat exchanger cleanings
- reduced use of cleaning chemicals and disposal of chemical waste
- low operation and maintenance costs
- minimal capital cost

▶ HTRI is the **exclusive** provider of vapor infusion technology. We currently offer a six-month trial that includes a free vapor infusion control device and an installation kit.

Contact us if you are interested in participating in a trial or would like a free presentation. Visit www.htri.net/vapor-infusion for more information on how vapor infusion can be applied to your unique application.

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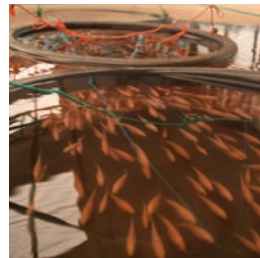
Our system has successfully been implemented in the industries highlighted below.



Drill ships and offshore rigs

Our vapor infusion system was installed on both the thruster and main engine coolers of a semi-submersible offshore drilling ship. Three months later, engineers determined that the thruster

performed better during pressure drop tests with high loads (including 100% load tests for 15 minutes). This customer subsequently implemented the vapor infusion system on all 16 heat exchangers (plus backups), resulting in significant improvement to the cooling system.



Fish farms and aquaculture systems

A commercial halibut hatchery uses plate heat exchangers to control the water temperature of its fish tanks. To reduce fouling in the tanks, the aquaculture farm had been backflushing the tanks weekly

and using hypo-chlorination twice a week. Our vapor infusion system was installed as an alternative. After three months, the company had eliminated chlorine and substantially reduced maintenance and operating costs.



Cruise and cargo ships

In one cruise ship case, two sets of main engine coolers (forward and aft) had operated for over a year without cleaning. Our vapor infusion system was then installed. After fourteen months using the system

(or 26 months in total operation), engineers opened each exchanger for observation. Neither cooler exhibited significant fouling, indicating that vapor infusion systems can improve performance and extend time between cleanings.



Processing and power plants

A sulfuric acid plant used seawater as a coolant on a shell-and-tube heat exchanger. Our vapor infusion system was installed. Customer testing revealed no rise in seawater iodine levels, and temperature

spikes were effectively stabilized. The system experienced a 6 °F increase in cooling water differential temperature, significantly enhancing the heat transfer process.

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