Curran international
Tubular Heat Transfer Services.

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An in-service in/out channel before and after coating; selecting a material to meet the worse-case conditions, including *steam-out*, is important to successful use of coating.

Specifying the Right Protective Coating for Worst-Case Conditions

When specifying an internal coating for fixed equipment in immersion service it's important to understand the operating conditions, temperature, fluid exposure, and whether the equipment is insulated.

But, not so fast – there are a couple of other factors to consider.

Steam Cycling

In many refineries and petrochemical plants utility steam is often circulated through equipment as a routine maintenance practice. At clients we visit, 150 PSIG appears to be the typical utility steam circulated through *product-side* of cooling water exchangers and channels.

This is about 365F, when converted to temperature. Even where steam is not circulated at the coated-surface, the conduction of heat through steel could blister a coating not rated for such temperature exposure.

Cold-Wall

This is not a widely discussed failure-mechanism. This failure-mechanism is found where a coated-substrate is in hot-immersion-service, and the opposite side is uninsulated to atmosphere, or in cold immersion service. The differential in substrate temperature – which might be as little as 70F – could result in blistering of the coating on the *hot-side*. Equipment like two-pass exchanger channels, or condenser water boxes are susceptible to *cold-wall* failure.

Coating manufacturers may offer *dry* temperature resistance on product data sheet, but equipment owners need to confirm the *wet or immersion* resistance limits of a coating. Our suggestion is, contact the manufacturer if wet or immersion resistance limits of a coating are not offered on the product data sheet.

When considering *steam-out*, it should be recognized that latent water persists in unopened cooling water exchangers; so *wet*-resistance of an applied coating should be considered.

Even fewer coatings are tested for cold-wall resistance, however confirming Atlas Cell test is data is an indicator of cold-wall performance.

Curran coatings are subjected to client field testing, third-party lab testing, and testing in Curran fixtures. Curran data sheets list results for the most common test protocols.

Curran 1000R, 1200 and 1500 offer guidance for immersion temperature resistance. Each of these coatings can tolerate operating immersion conditions to 365F. Curran 1500 has passed cold-wall testing in a pressurized Atlas Cell to 365F.

Contact Curran International for more information about its Curran product line for immersion coatings.
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Curran Cleaning Demo Proves
Grit-Blasting Has Global Reach

Refinery inspection and reliability representatives gather at a Saudi Aramco maintenance facility where a grit blast cleaning demonstration was performed and compared against hydro-lancing. **(fig. 1)**

Straight and U-tube carbon steel exchangers were made available. Hydro-lancing had been completed, but remaining surface-scale restricted the inspection probe from passing down tube more than a few inches from end. **(fig. 2)**

A borescope image shows comparable tubes hydro-lanced and grit blasted in 40-seconds! An inspection probe passed through the entire tube, satisfying inspectors with data acquired. **(fig. 3)**

Curran has international partners and representatives in the Mideast, Singapore, Rotterdam, and Edmonton, providing exchanger tube-cleaning and coating services.

To learn more about Curran International's international reach and scope, please contact Alex Barre, abarre@curranintl.com, 281.339.9993.

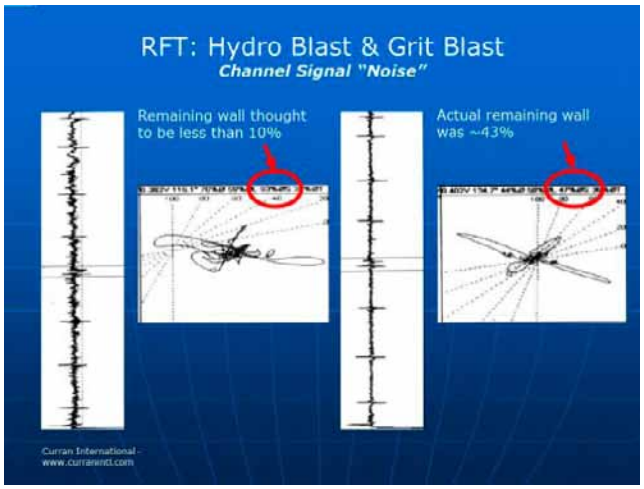


fig. 1

fig. 2

fig. 3

Now, New, Ultra-Thin, High-Performance Materials
Available for Client Trials

The Research and Development team at Curran International is breaking ground with several new and very exciting coating materials. These new materials are anti-fouling, highly-repellent, and ultra-thin.

The effort has focused on hybrid and inorganic materials, ceramics, silicones, and sol-gels, which are performing exceptionally well in testing-demonstrating thermal stability, surface tension and repellency.

Successful in Laboratory and Limited Field Trials

Applying these materials has also proven successful in laboratory and limited field trials. Curran has been able to create repeatable application procedures using these materials for a wide range of equipment geometries – heat exchanger tube IDs and ODs, plate and frame exchangers, and tower-packing elements.

When Curran started this development project, many materials were under consideration. After rigorous testing, a limited number of coating formulations have emerged. Each of the formulations has shown great potential for real world applications.

These carefully-formulated materials have been performing great in Curran's laboratory. Each formulation has been subjected to a variety of standardized tests, including adhesion-pull test, extreme temperature thermal stability, and submersion atlas-cells-device tests.

Test These New Formulations for Yourself

Clients who may be seeking solutions to heat exchanger fouling and corrosion problems are invited to participate in demonstration program or test trial using these innovative coating materials. Curran experts are available to determine the solution for your fixed equipment fouling challenges.

Please contact Patrick Desmarais, pdesmarais@curranintl.com, 281-339-9993

Exchanger plate with Curramix release coating applied to 23 microns total thickness.

Catch Curran

ARPM Maintenance and Reliability Conference

May 22-25

Henry B. Gonzalez Convention Center, San Antonio, TX

AFPM
American
Fuel & Petrochemical
Manufacturers

Tube ID Coating
Solves Mild-Steel Problems in Cooling Water

Cooling water exchangers are plagued by mineral precipitate scaling, particulate and bio-fouling.

At refineries and petrochemical plants, where hydrocarbon product can exceed 225F on the shell side, cooling water scaling is accelerated at hot sections in exchangers.

Low cooling water flow rates, due to exchanger location in the circuit or overloaded utilities, further exacerbate fouling and scaling.

These *bad-actor* exchangers handicap unit duty – requiring blind, pull and clean procedures during unit operation; or enduring poor duty until next turnaround-event. The severity of cooling water performance with these exchangers handicaps exchanger duty, creates operational bottlenecks, and contributes to poor reliability.

Curran coats *bad-actor* cooling water exchangers, applying a thin film hydrophobic coating for improved release and the elimination of tube-scaling. At 12 mils average thickness, the coating minimizes boundary-layer drag and maintains water at the heat-transfer surface.

When initially installed, there is marginal difference in duty of a new uncoated exchanger and a new coated exchanger. As time passes, client-owners report measurable benefits of coated exchangers. Operating conditions are unique, and while designs engineers should consider thermal duty based on coating heat transfer, the significance of reduced surface roughness of a coated substrate often is not calculated.

Anecdotal client reports show the benefits of coating exchangers:

- A Texas fractionation plant, using tube ID coating, has eliminated bi-annual tube cleaning of its large shell and tube exchanger.
- A Gulf Coast refinery, using tube coating for its known *bad-actor* cooling water exchangers, reduced high occurrence of *leaker-repairs* and on-the-run blinding to clean exchangers.
- An oil sands upgrader extended heat transfer duty of cooling water exchangers 2x – improving uninterrupted run of the exchanger between turnaround events.

Highly functional coatings combined with Curran proprietary application methods result in full-circumferential ID coverage, uniform, homogenous depositions are the application standard.

- Curran 1000T is the workhorse for cooling water. This superior coating is suitable for new or used exchangers, U-tubes. Applied in two coats, 1000T delivers value-added benefits in a fast turnaround.
- Baked phenolic is for cooling water and some chemical services. This coating must be shop applied, requiring four to six coats for a pinhole-free application at less than 10 mils total thickness.
- Curran applied fluoropolymers – PFE, PTFE – are used for exchangers in hot, corrosive services. These coating, too, are shop applied; and require a bake-cure to 650F.

A Closer Look

A Midwest refinery found coated-exchangers exhibited improved resistance to cooling water corrosion. The refinery was able to make a comparable assessment of coated versus uncoated exchangers, because the exchangers were installed at the same time. Both coated and uncoated U-type bundles were installed during the same refinery turnaround.

An image of a **coated exchanger (fig. 1)** shows no cooling water scale and fouling. A minor amount of cooling tower debris was rinsed from tubesheet. The coated exchangers did not require hydro-lancing and images were taken in *as-is* condition. The coating was in good condition, and no RFT inspection performed.

fig. 1

The **uncoated exchanger (fig. 2)** was pulled for hydroblast tube cleaning of cooling water foulant and scale. RFT inspection was performed on the tube IDs. The inspection found tubes with >70% indications after just four-years of service.

fig. 2

The coated bundle was protected from water-side propagated corrosion. The thin film coating is an inert, non-reactive barrier. A coated tube may be pressure washed, if needed, using low pressure water. Some clients have reported being able to free cooling tower debris from coated bundles by simply *back-washing* the bundles.

More than 50% of the exchangers coated by Curran International are U-tube exchangers. The reduced friction of coated steel sustains cooling water flow through the exchanger, even where operating conditions are near 3 FPS.

Please contact Curran International for more information about solving cooling water exchanger challenges.

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