Curran international
Tubular Heat Transfer Services.

March, 2021

Curramix 3500™ Anti-Foul Coating

Improved Crude Preheat Exchanger Duty

Crude preheat exchangers are essential to refinery manufacturing and operational efficiency. These exchangers are closely monitored for fouling and pressure drop. When operators are able to maintain greater levels of duty for longer periods, the return to the unit is improved production yield, energy savings, and CO2 reduction.

To compare the expected benefits of Curran anti-foul coating applied to a crude preheat exchanger, the study compared Curramix 3500™-coated exchanger and an uncoated exchanger.

The Data Showed Improved Energy Duty, and Significant CO2 Savings

The data projected that a Curramix 3500™-coated exchanger would operate at reduced backpressure, provide improved energy duty, and contribute significant CO2 savings.

The study also showed the coated exchanger would provide a $173,000.00 maintenance and energy benefit-expenses compared to an uncoated-exchanger-over a two-year run. The study allowed for cleaning the uncoated exchanger at a one-year interval.

Heat Transfer Research, Inc. (HTRI) Software Analyzed Comparable Performance Over One and Two-Years

Analysis was performed on a typical TEMA AES exchanger found mid-train in crude preheat arrangement, processing desalted crude tube-side and HVGO shell-side. Tube-side and shell-side operating rates and temperatures, as well as fuel values and furnace efficiency are identified in the report.

The three-part study projecting the expected performance of a coated crude preheat exchange, is available at this link.

The carbon steel exchanger was coated down the full-length tube IDs with Curramix 3500™ using a thin film, 25 to 35 microns, of Curramix 3500™ ceramic material. This film reduced the surface energy of the coated substrate to 30 dynes per cm squared. This reduction improved release performance four-fold, compared to uncoated carbon steel.

Confirmation of In-Field Trials

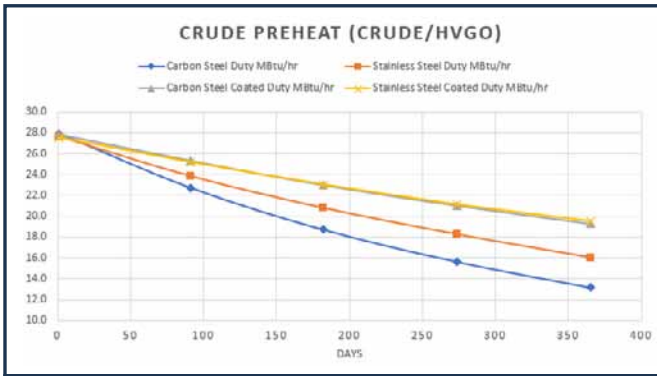
The study supports what has been reported from a range of in-field trials. Coated exchangers installed in refinery operating units demonstrate effectiveness after more than 36-months in-service. Anecdotal reports claim operation run-times three-times longer when compared to routine maintenance on those same exchangers.

A Large Portfolio of Effective Coatings- Applied Worldwide

Curran has developed advanced low-surface-energy coating materials targeted for heat exchanger fouling in crude and hydrocarbon services. Materials and application techniques have been developed for exchangers vacuum bottoms, FCC slurry, produced-water, desalting services and fouling services.

The Curran heat exchanger portfolio includes organic hybrid, ceramic, and Teflon™ coating materials targeted at crude processing and coking in operating services to 750F. Selected Curran materials deliver functional performance at just 5 to 15 microns total thickness.

To Learn More about Curran's heat exchanger anti-foul coatings, and Curran's portfolio of heat exchanger coatings, applied worldwide, please contact Edward Curran, (281) 339-9993 or ecurran@curranintl.com.



Study data projects the performance of coated versus uncoated exchangers over one year. Heat transfer efficiency, measured in millions of BTUs per hour, is shown on the vertical axis. The uncoated exchangers, orange and blue lines, show significantly reduced efficiency, as a result of fouling, compared to the coated exchangers, the yellow and gray lines.

Specify Curran Coatings,
Your Long-Term Protective Solution.

No Need to Settle for Short Service Life.

Too often plant fixed-equipment suffers the consequences of short-service life from an inadequate or poorly-applied protective coating.

Surrendering to the low-expectation that a coated component will survive only a single 4 to 6-year operating period before maintenance-turnaround is unnecessary and results in a poor economic payoff.

Contributing to coating failure:

- Equipment operation exceeding a coating's functional design
- Poor surface preparation, residual contaminants, out-of-spec application
- Subjecting an uncured-coating to immersion service

Don't surrender, expect more!

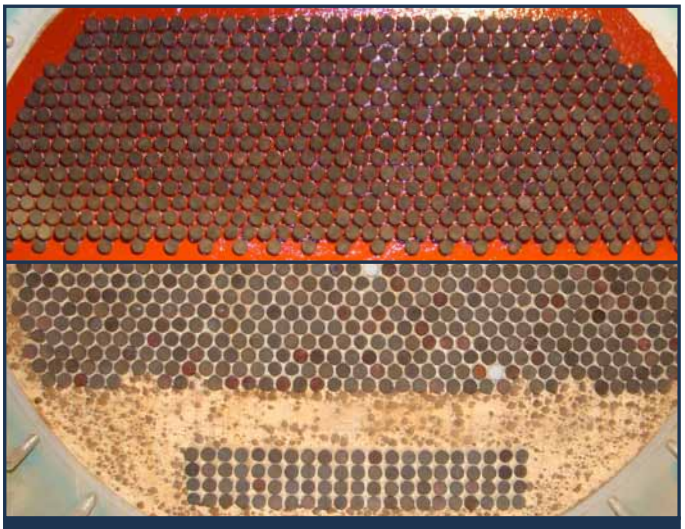
Corrosion to exchanger tubesheets, channels, and bonnets due to a damaged or failed coating risks equipment and operating integrity. Unplanned maintenance adds tasks to an outage schedule. In these situations, costs for repairs are commonly at expedited rates.

Curran Coatings are formulated for extremes of refinery and petrochemical cooling water services.

Curran 100% solids epoxy coatings have been specified for all cooling water services at refinery and petrochemical plants, worldwide. Curran Coatings, which are resistant to *immersion* temperatures to 365F, provide high-adhesion performance and resistance to cathodic disbondment

Know conditions, no early failure!

Selecting a coating to meet and exceed the functional requirements of all operating conditions is the initial step to improving coating service life. Unit on-line steam cycling and operations chemical cleaning must be considering for a coating to survive *all* conditions.



(Above) Chiller tubesheet before (L) and after Curran 500™ Coating. Tubesheet is protected from galvanic corrosion, tube and tubesheet crevice joints are sealed.

Coating professionals attribute 70% of coating performance to surface prep.

The coater must have the discipline satisfy surface prep for clean-blasted steel, and ensure surface contaminants have been remediated, and satisfy anchor profile requirements to standards of SSPC or NACE.

Coating recommended film thickness must be followed. Too-thin, risks early permeation. Too-thick, risks cracking, and poor inter-coat adhesion.

Even a well-applied coating will fail if returned to service before fully-polymerized. By using heat lamps, and circulating warm air to reduce cure-time, resourceful contractors have developed ways to accelerate field-curing.

Curran's shop oven allows full-cure of an epoxy coating in about four-hours. The oven enables Curran to specialize in fast turnaround of exchanger component coating.

Curran Coatings Available for Contractor Applications:

Curran 500™ — Suitable for all power plant and chiller cooling water systems. This advanced, two-part 100%-solids-epoxy, with versatile formulations, can be applied using spray, brush and roll-coated. Curran 500 is best for chilled-water tubesheets and steam condensers.

Curran 1000R™ — This coating is used in high-temperature immersion service, as well as cooling water, hydrocarbons and process streams. A proven two-part 100% solids novolac epoxy, Curran 1000R can be brushed or rolled. Temperature-resistant in water, steam to 365F; this durable coating tolerates excursions/steam outs to over 400F. Curran 1000R is also suitable for exchanger tube sheets

Curran 1200™ — This Curran Coating, with water/steam immersion temperature resistance to 365F, is used in tanks and vessels in hydrocarbon and solvent services. The coating is a two-part 100% solids novolac epoxy formulated for high-volume coating applications. A single coat can be spray- applied to 20 to 24 mils to tanks and drums.

Curran 1500™ — This proven coating, formulated to provide resistance in *cold wall* services, pressurized Atlas Cell tested in DI water at 365F, is used to repair corroded steel. When fully-cured, Curran 1500, a 100%-solids hybrid novolac epoxy, is machinable; and very suitable for uninsulated vessels, channels, bonnets, restoration of flanges.

To Learn More… please contact Curran International, 281.339.9993. For US domestic Ed Deely edeely@curranintl.com; or Alex Barre abarre@curranintl.com for Canada and overseas sales.

Curran Coatings are manufacturered in Greater Houston, Texas, USA. Curran will provide information about sizes and prices.

Hydraulically-Expanded Tubing
for Critical Exchanger Repairs

Curran Moves Quickly to Implement In-Situ Repair

Alloy tube liners and partial length sleeves hydraulic liners are a reliable method for repairing defective tubes in a heat exchanger, rather than merely plugging them.

Using hydraulic expansion method, Curran restores defective tubes back to active service and extends the life of other tubes that have indications of pitting, cracks or excessive wall loss, but have not yet failed.

Curran to The Rescue! Petrochemical Application

A forced outage at a Midwest petrochemical plant initiated a call to Curran for a solution to exchanger tube leaks that were delaying restart until the defective tubes could be plugged or repaired.

Due to the large number of defects, plugging the leaking tubes was not an option. The number of tubes requiring plugging would mean a drastic reduction of thermal performance of the unit and the loss of tens of thousands of dollars of reduced output and lost revenue a day!

Desuperheater exchanger, image shows the tubesheet where about 400 tubes with greater than 70% surface indications and required repair liners were found. The image also shows tubes marked for repair.

After consultation with the facility's management, Curran determined the tube-end insert dimensions for sleeve-material recommended by the plant. Curran sourced a quick turn delivery of 1,200 alloy sleeves for installation. In just days following the plant's call, a Curran crew and tooling was onsite.

Shortly following the installation, the plant performed a hydro test without incident.

Curran to The Rescue! Power Plant Application

A Midwest-based power plant contracted with Curran to repair tubes in the desuperheater of a Feedwater Heater (FWH). Plant staff performed NDE on 100% of the tubes in the desuperheater. Ten percent of the tubes in the FWH, many of which were frequently taken down due to tube leaks, were also NDE tested.

After performing the Eddy Current Examination, Curran's crew cut, pulled and removed a tube sample for visual inspection and metallurgical analysis. This work determined the tubes were experiencing OD steam impingement in the area of the steam extraction nozzle.

Following consultation with the plant management, a repair plan was developed and implemented. The plan included installing alloy sleeves in 400 tubes that had indications of 70% or greater impingement in the area of the extraction nozzle and impingement plate. In these 400 tubes, Curran installed four-foot sleeves that extended from the face of the tubesheet past the desuperheater shroud. Once repair sleeves were installed, the heater was closed, hydro-tested and returned to active service.

Alloy Liners Restore Tubes for Operation

Hydraulic liners can be very useful in providing power, petro-chemical, and pulp and paper facilities with a viable method to repair defective tubes rather than plugging or rebuilding the tubular heat transfer equipment.

Curran installs inlet ferrules, partial length sleeves, and full-length tube liners at any location within the heat exchanger.

To Learn More… about how you can enhance the reliability of your tubular heat transfer equipment using Curran's hydraulic expansion process, please contact Ed Deely 281.339.9993 edeely@curranintl.com

See an animation of full-length tube liner installation at www.curranintl.com

Catch Curran

As of this writing, 2021 industry conferences and exhibits have been cancelled through the end of the year.

To catch Curran, please click here to request a live, personalized presentation with Curran — via Microsoft Teams.

To learn more about a presentation, or about Curran Coatings and Curran's worldwide service, please contact Alex Barre, 281.339.9993 abarre@curranintl.com

Curran is at your service. Worldwide!