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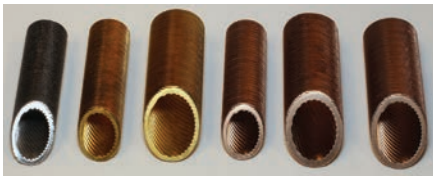


UOP High Cond™ Tubing

Enhanced hydrocarbon condensing tubes for grassroots and revamp applications

UOP's enhanced hydrocarbon condensing tubes with high heat transfer coefficient reduce exchanger size and cost in grassroots units, maximize duty for expansion revamps, minimize LMTD for greater energy efficiency, and reduce CW requirement in horizontal cooling water condensers.

INTRODUCTION

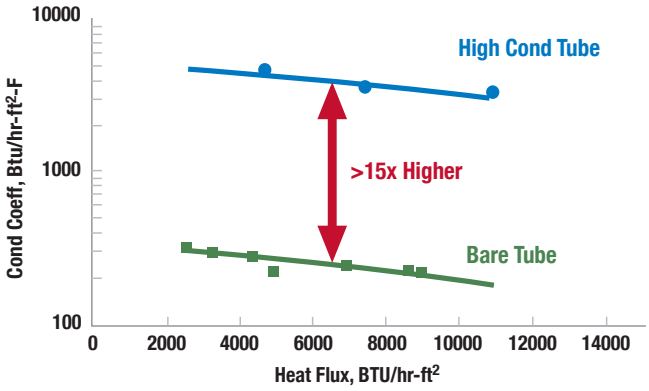
UOP is a proven provider of enhanced heat transfer technology with over 40 years of commercial experience in this field. UOP has successfully developed and commercialized numerous condensing surfaces including proprietary OD tube fluting profiles for shellside condensing in vertical heat exchanger orientations as well as various spiral ID fin profiles for tubeside condensing in horizontal heat exchanger orientations. Most recently, UOP has expanded its enhanced heat transfer product portfolio to include High Cond tubing for shellside condensing in horizontal heat exchanger orientations.

High Cond tubing is an enhanced hydrocarbon condensing technology that is especially well-suited for use in horizontal cooling water condenser applications. The proprietary tube OD surface has been optimized to minimize liquid condensate film thicknesses and improve condensate drainage. These technical features maximize the tube's condensing and overall heat transfer coefficients. The vastly-improved heat transfer performance allows reductions in capital investment, achievement of higher heat exchanger capacity, and/or optimization of process operation.

MAXIMIZED CONDENSING COEFFICIENT

The surface of the High Cond tube reduces the thickness of the liquid condensate layer on the tube. The surface tension draws liquid into the gaps in the enhanced condensing surface thereby reducing the condensate thickness at the top. The shape of the gaps in the enhanced condensing surface create small separations that act as capillaries. Surface tension helps draw the liquid condensate away from the top surface of the tubes, thinning the liquid film and greatly increasing the condensing coefficient. Condensate then collects and drains from the bottom of the tube, improving overall condensing performance. The improvement in condensing performance is significantly greater than that which can be obtained merely by extended area surfaces. In fact, the condensing coefficient for High Cond tubing is more than 15 times greater than that achieved with a bare surface.

CONDENSING PERFORMANCE



REVAMP EXISTING HEAT EXCHANGERS FOR HIGHER CAPACITY

In plant revamps, the superior performance of High Cond tubing is extremely beneficial in the retrofit of existing tube bundles and/or condensers to achieve higher capacity. Retrofitting heat exchangers with High Cond tubes allows existing shells, heads, piping and valves to be reused, conserves existing plot space, requires no modification of existing structure and minimizes plant downtime.

High Cond tubing is also very beneficial in retrofitting cooling water condensers which are summer time limited.

REVAMP EXAMPLE

Depropanizer Condenser

	Before	After
Tube Type	Bare	High Cond
Duty, MW	17.8	26.7
ΔT, °C	8.6	6.2
U Value, W/m² °C	618	1647
Tube OD, mm	19.05	25.4
Area, m²	3,043	2,603
Hx size, mm	1830x12000	1830x12000

CAPITAL SAVINGS FOR GRASSROOTS PLANTS

Specifying High Cond tubing in the design of new plants can save considerably on capital and installation costs. The total installed cost of the heat exchanger is significantly lowered, especially in applications where multiple bare tube shells are required. In those cases, using High Cond tubing will typically reduce the number of required heat exchanger shells in half. This results in large cost savings associated with lower heat exchanger fabrication costs, less plot space, smaller/lighter exchangers, less piping, smaller structure and less civil foundation.

Examples of applications for High Cond tubing include propylene splitter overhead condensers, propylene refrigerant condensers, naphtha splitter condensers and other water cooled shell and tube condensers.

GRASSROOTS EXAMPLE

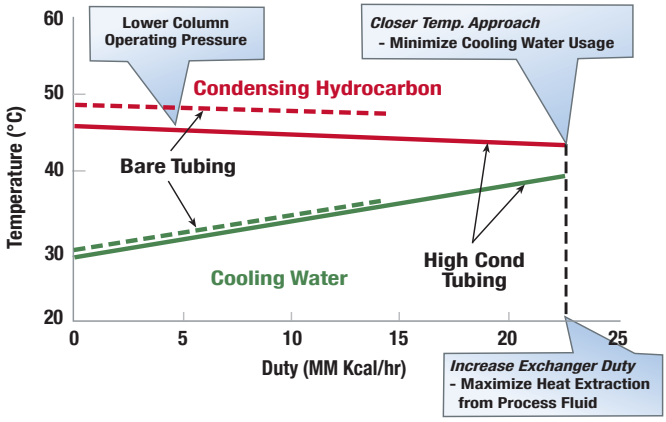
Propylene Splitter Overhead Condenser

	Bare Tube	High Cond
Duty, MW	57.4	57.4
T,°C	8.0	8.0
U Value, W/m² °C	681	1647
Area, m²	10,536	4,362
Number of shells	4	2

RELIABLE OPERATION AT LOW ΔT

Due to it's higher heat transfer performance, High Cond tubing can be operated more optimally at closer temperature approaches, thereby allowing the maximum heat extraction from process fluids, column operating pressures to be reduced, and/or the minimization of cooling water usage.

PROCESS IMPROVEMENTS



DESIGN AND PROCESS CONSIDERATIONS

High Cond tubing is available in a variety of ASTM tube materials to suit your process conditions:

- Carbon steel is suitable for most condensing applications utilizing fresh cooling water
- Copper alloys (Admiralty brass or 90/10 Cu-Ni) are available when sea water is used to condense the process fluid
- Super-ferritic stainless steel is available for either sea water cooling or for services with corrosive process condensing fluids

High Cond tubes can be manufactured in multiple sizes, and in single-enhanced or double-enhanced geometries. The double-enhanced variety has supplemental helical fins on the inside of the tube to further improve overall heat transfer performance and reduce fouling potential of the cooling water stream. The helical fins function to disrupt the thermal boundary layer and create turbulence within the tube. Tubeside velocity and pressure drop criteria are carefully evaluated during the heat exchanger design phase. The range of High Cond tube products allows UOP to optimize the exchanger performance within the customers design constraints (i.e – process flows, duties, pressure drop, summertime cooling water limitations, etc).

Designing a High Cond exchanger is similar to designing one having conventional tubing. UOP has developed proprietary correlations modeling the High Cond condensing surface enhancement. The thermal performance of the exchanger is simulated with a combination of proprietary and commercial software programs.

High Cond tubing is provided with plain tube ends to ensure easy installation with tube sheets and tube baffles, via conventional heat exchanger fabrication techniques. The nominal OD of the enhanced surface portion of the High Cond tubing is essentially the same as the nominal OD of the bare ends. This also ensures easy bundle fabrication via conventional heat exchanger techniques.

For more information

For more information, please contact your UOP representative or visit us online at www.uop.com.

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