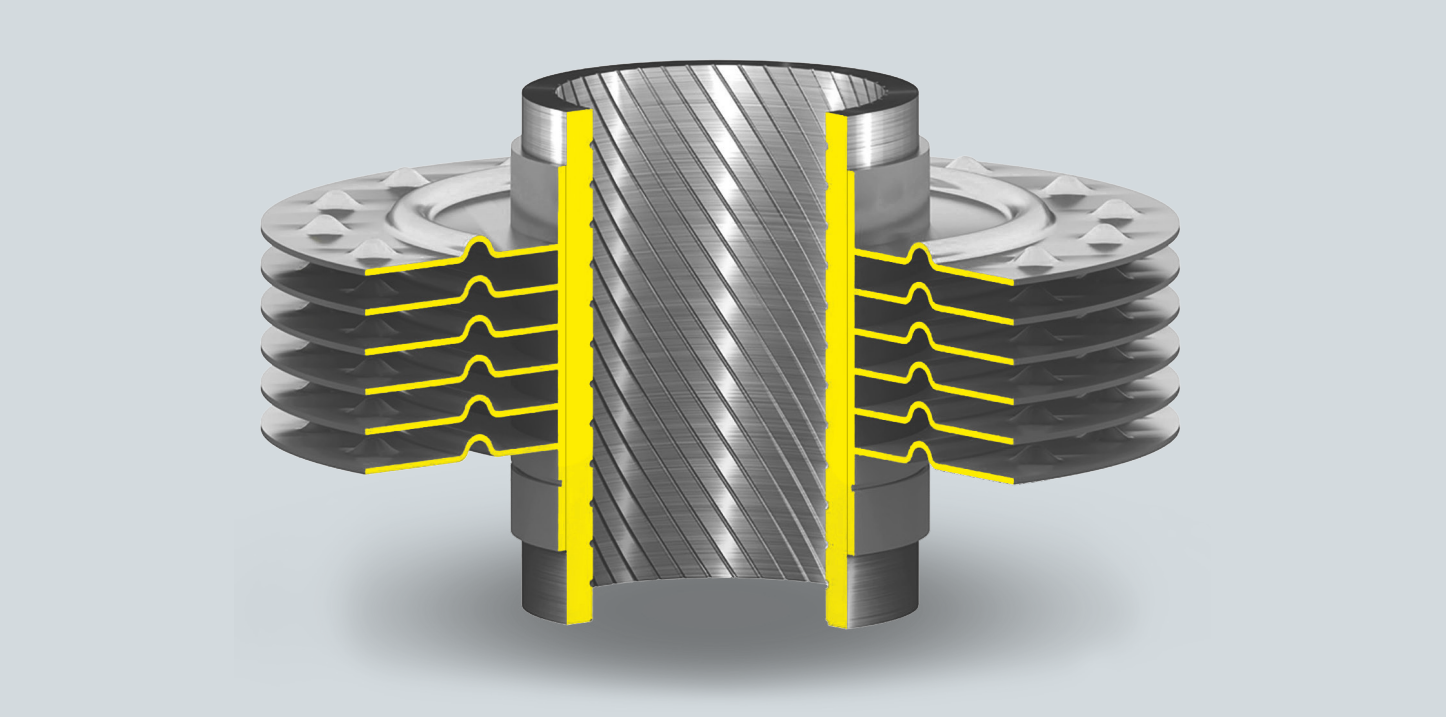
Kelvion THERMAL SOLUTIONS

DIESTA Tubes

EFFICIENT & COMPACT DUAL ENHANCED FINNED TUBES



DESCRIPTION

DIESTA is an innovative new finned tube technology, dedicated to air cooled heat exchangers, using enhanced surfaces, that has the ability to improve plant efficiency and reduce construction costs without deviating from the robust design requirements of oil & gas industry standards such as API 661.

KEY APPLICATIONS

- LNG air-cooler fields including MR compressor inter- and aftercoolers, C_3 refrigerant coolers (desuperheater, condenser and subcooler)
- Ethylene quench-water air cooler fields (focus naphtha-based crackers)
- Other areas: gas processing plants, gas compression stations, refineries
- Available for greenfield and revamp debottlenecking projects

BENEFITS

Depending on project objectives, either:

- CAPEX savings: Up to 20 % air-cooler field length reduction
- Savings in structures, piping, wiring and foundation

Increased Revenue:

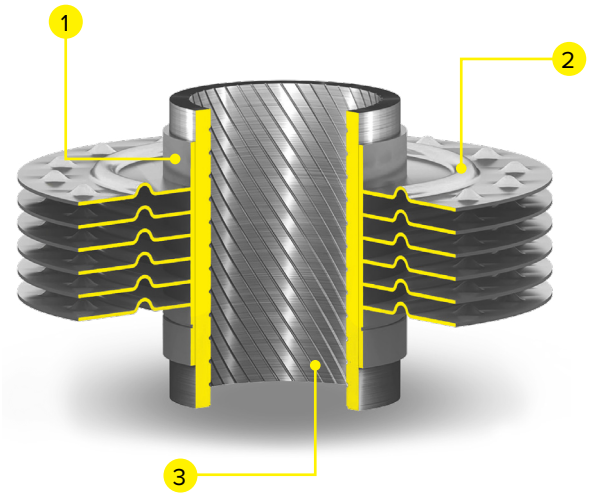
- Substantial benefits depending on individual process conditions. LNG aircooler optimization does lead to up to 3 % capacity increase

Improve CO_2 footprint:

- System efficiency improvement (reduction of compression work)

DESCRIPTION

The DIESTA tube is a bimetallic finned tube with an aluminum sleeve (1) fully covering the base carbon steel tube. The outside aluminum fins are embedded into the grooves of the aluminum sleeve. To optimize the air-and tubeside heat transfer performance enhancement structures are applied on both sides. The aluminum fins on the airside combine both a groove and a dimple structure (2). Airside mechanical qualification confirmed robustness towards fouling, cleaning as well as mechanical strength of the fins equally to standard extruded finned tubes. The tubeside has an internally helical fin structure (3) ensuring an increased of tube side heat transfer coefficient while controlling the pressure drop. DIESTA Technology is a development by the cooperation of Wieland®, TechnipFMC® and Kelvion.



DIESTA PRODUCTION PROGRAM

TUBE MATERIAL	TUBE OD	PLAIN END CORE TUBE THICKNESS	FIN MATERIAL	FIN DENSITY
Carbon steel (ASME SA179 & SA334 Grade 6)	**1 inch 1 ¼ inch 1 ½ inch**	**2.11 mm (in accordance with API 661)**	**aluminium 1100**	**10 fpi (394 fpm)**

DIFFERENT INTERNAL STRUCTURES ARE AVAILABLE FOR		
Gas cooling	Condensation	Liquid cooling (incl. high viscous fluid Pr < 100)

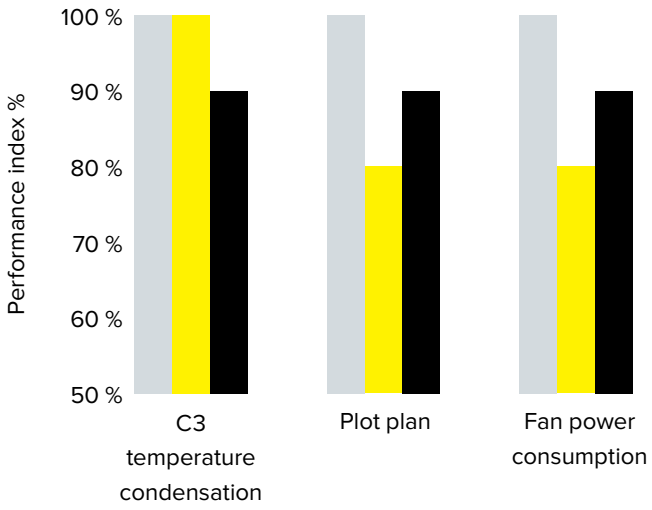
CASE STUDY FOR LNG AIR-COOLER FIELD

Assumptions:

- APCI type C_3/MR LNG process
- Design optimization for whole air-cooler field with services HP and LP MR after-coolers, C_3 ref. desuperheater / condenser / sub-cooler and others

3 potential benefits depending on project objective:

- Either maximize LNG production capacity or to minimize CO_2 footprint by optimizing C_3 condensation temperature
- Either CAPEX minimization by optimizing plot plan
- Or minimize CO_2 footprint by reducing fan power consumption



Standard Design 1: standard finned tubes

DIESTA Design 2: CAPEX reduction with plot plan optimization

DIESTA Design 3: OPEX optimization by reducing the C_w condensing temperature and CAPEX reduction by optimizing footprint of other services

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