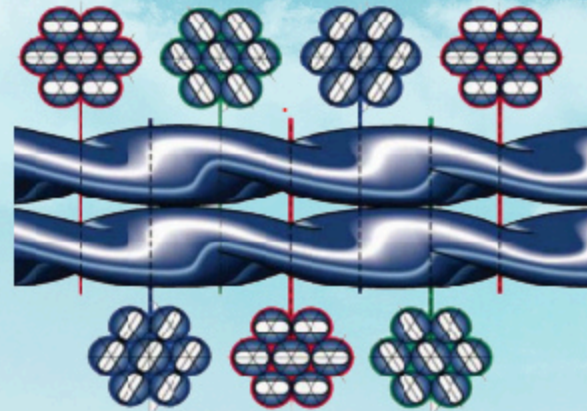
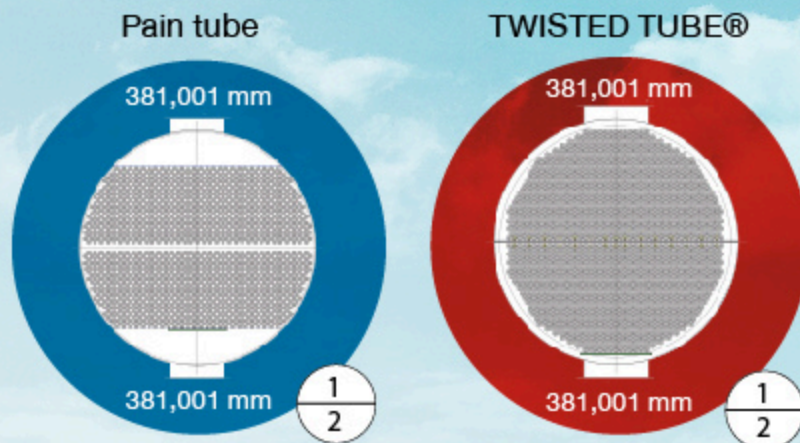


TWISTED TUBE® Bundle Construction

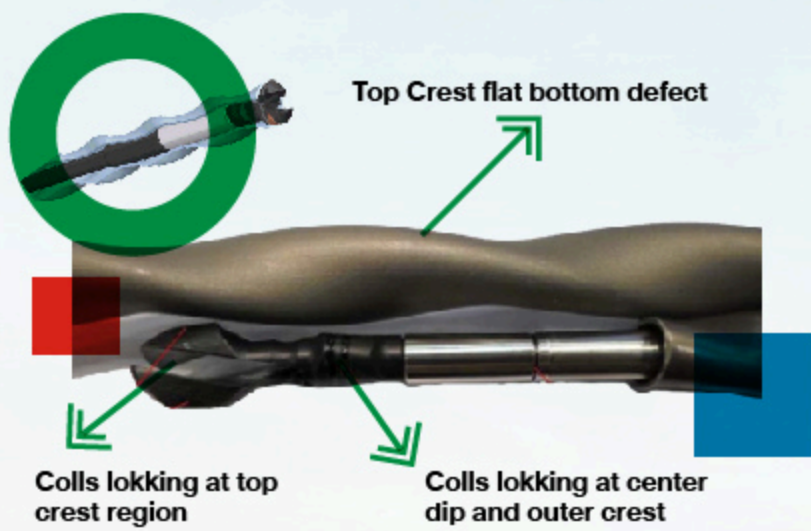
- Tubes are firmly supported.
- Vibration Free : $V_{cr} > 305$ m/s (1000ft./sec)
- No single tube can vibrate.

$$Q = U_0 * A * F * LMTD$$

= Overall Heat Transfer Rate
 = Heat duty
 = Surface Area
 = Temperature Correction Factor
 = Log Mean Temperature Difference



Inspection



TECHNICAL INFORMATIONS

INSPECTION EQUIPMENT

BRAND:	Eddyfi	SOFTWARE:	Magnifi
MODEL:	Ectance 2	TECHNIQUE:	RFT (Twistec probe)
PROBE:	6 mm.	FREQUENCY:	2.8 KHZ.

CLIENT/EQUIPMENT DETAILS

CLIENT:	PTT GSP	LOCATION:	GSP6 plant
EQUIPMENT NO:	3603-E003A	MATERIAL:	A-179
TUBE SIZE (ODxWT):	19.05 x 2.11 mm.	TOTAL TUBE:	4750
LENGTH:	6000 mm.	INSPECTED TUBE:	395
TEST SIDE:	Tube sheet / Front	TEST DATE:	11-12 JULY 2021

Cleaning



SHELLSIDE PRE-CLEANING

- Remove shroud
- Do not remove bands

SHELLSIDE HYDROBLASTING

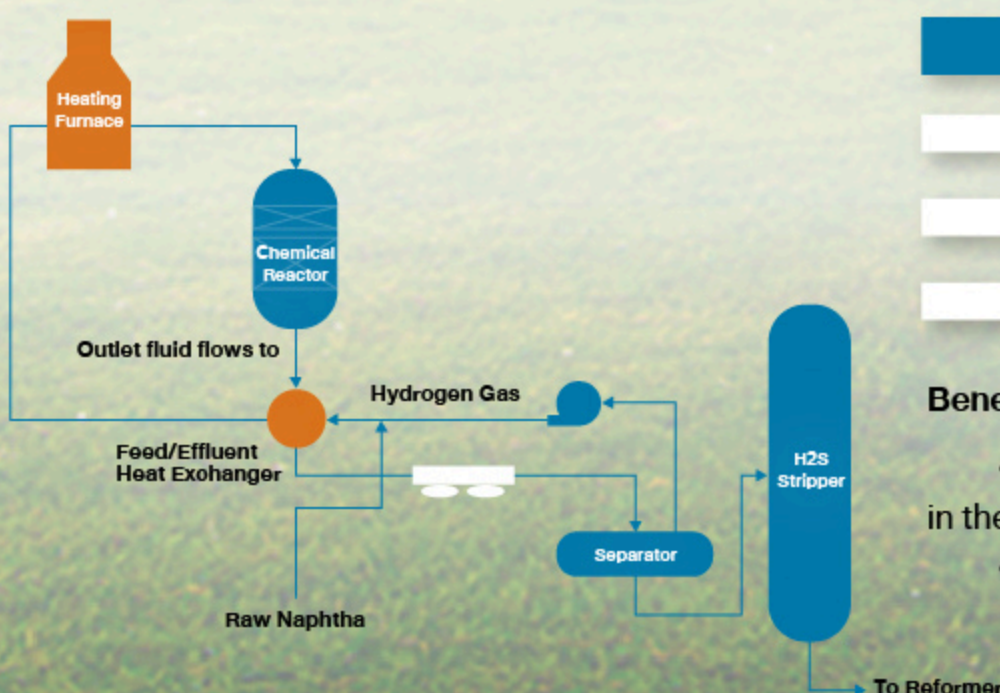
- Cleanable triangular pitch bundle due to cleaning lanes.



Case Study : Refinery Plant

To Modified Naphtha hydrodesulfurization equipment

by remove sulfur and nitrogen from naphtha, the raw material for catalytic reforming equipment



Before	After
1,914	3,586
350	395
10	5

Heat Transfer Area (M2)
 Overall Heat Transfer Coefficient (W/m2 K)
 Heating Furnace Combustion (MW)

Benefits of modification : Energy Conservation

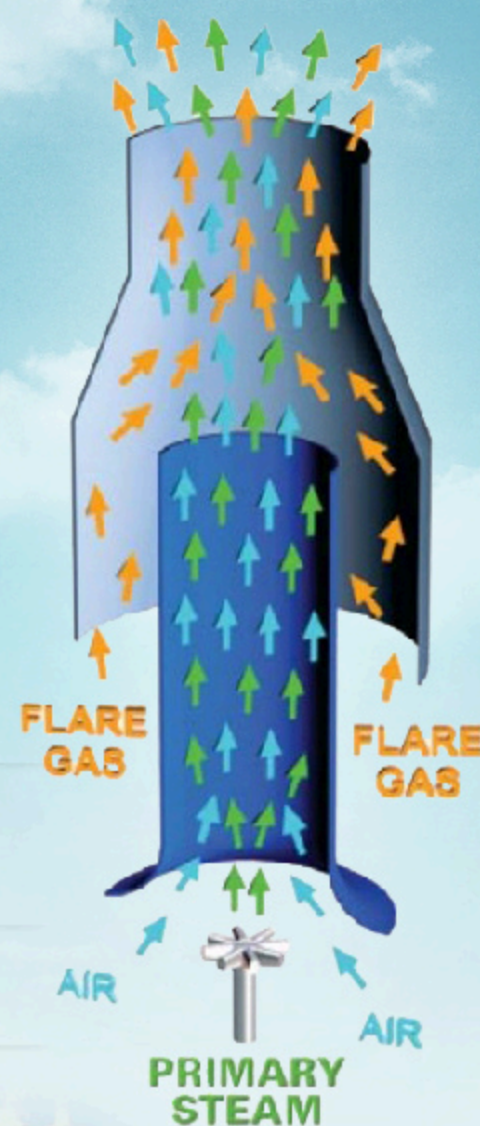
- Improved heat transfer efficiency reduces the amount of combustion in the heating furnace
- ~ 5MW Energy savings

XP Flare

Steamizer XP

- Minimize Smoke
- Reduce steam consumption
- 30% - 40% less steam for smoke suppression

40% - 60%
Increased smokeless
capacity for a given
steam flow rate



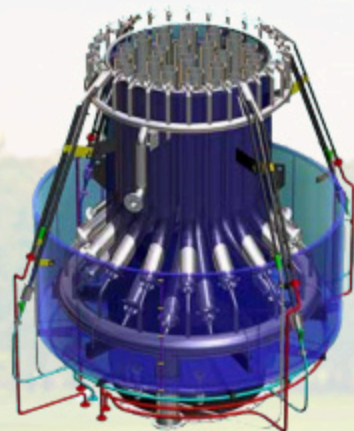
FEATURES

- Ultra-high smokeless capacity
- Low noise design
- Eliminates steam capping
- Low steam/gas ratio for smokeless flaring
- Single steam-line option
- No center steam required
- Ultra-low minimum steam capability

BENEFITS

- Minimizes environmental / community impact of flaring
- Extended tip life
- Reduced steam consumption
- Simple operation
- Minimizes over-steaming
- Significantly reduced steam capability

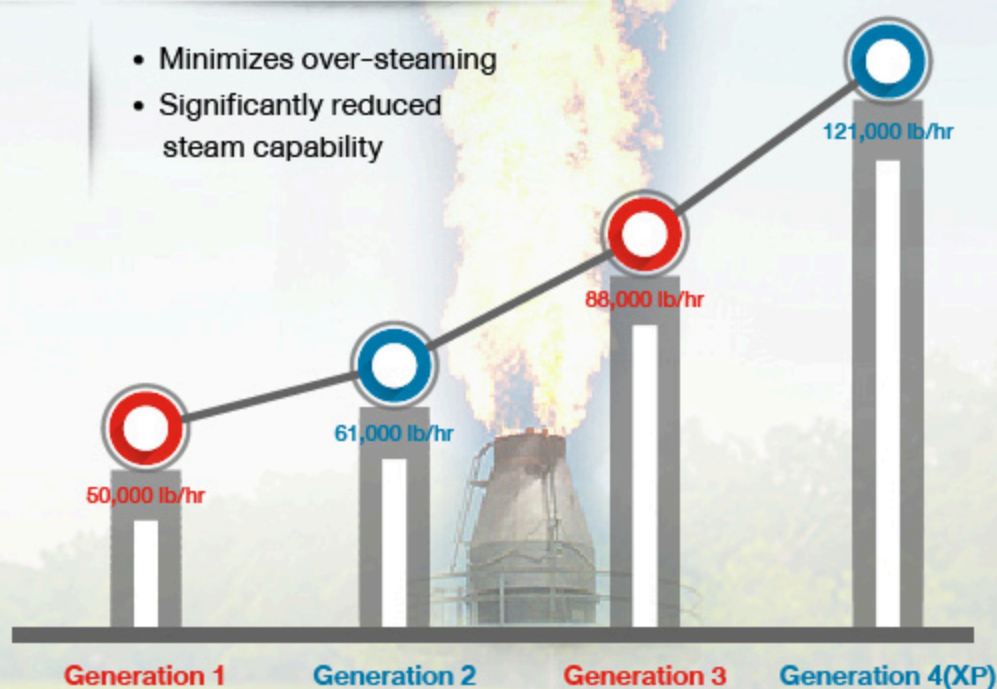
Traditional



Steamizer HSA
Flare tip



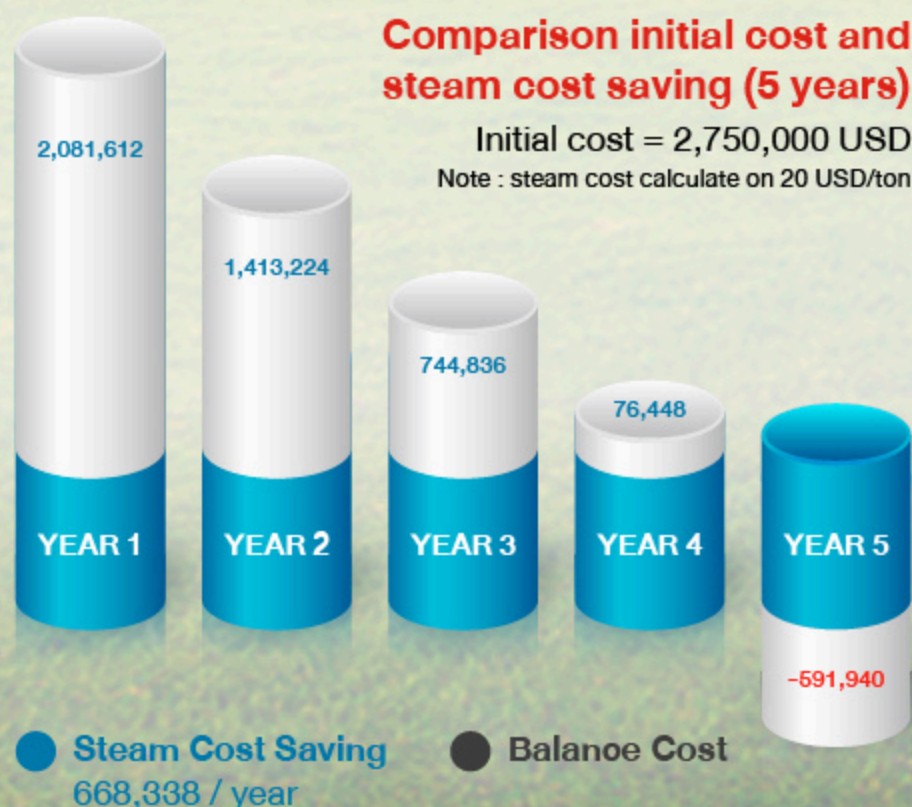
QS
Upper Steam Flare



Propylene Smokeless Performance
Flow Rate (lb/hr)

Case Study : Aromatic Plant

Equipment : XP Flare



	Steam Saving	Existing Flare Tip	XP Flare tip with Reduced steam (CSR)
Smokeless R0 % of max capacity		8% (135tph)	10% (168tph)
Smokeless R1 % of max capacity		10% (170tph)	13% (221tph)
Cooling Steam		3,200 kg/h	500 kg/h
Purge Gas		18.6 M3/h	74.5 M3/h
Yearly Steam Saving		-	33,419.4 tons
6years CO ₂ saving (vs existing technology) TCO _{2e}			32,000 tons (approx.70% Reduction)

● Steam Cost Saving 668,338 / year ● Balance Cost

Column Internal Improvement

- **Decrease Reboiler / Condenser Energy**
 - Decrease Fuel Cost
 - Decrease Steam Consumption
- **Increase Turndown Ratio**
- **Increase Capacity / Efficiency**



FLEXITRAY®
Valve Trays



FLEXIPRO®
Valve Trays

Next Generation FLEXIPRO® valve trays

- Capacity increase up to 30%
- Enhanced push and sweeping effect over the tray deck to remove solid deposits - Mitigates the risk of fouling and achieves longer run lengths
- Fixed valve - Increased reliability
- Fixed valve - Uniform vapor distribution maintains tray efficiency over the full operating range

INTALOX® ULTRA Random Packing

Bridging the gap between capacity and efficiency.

An innovatively designed structure that maximizes the effective surface area.

The low pressure drop and high capacity of this packing:

- Allows smaller diameter for new columns
- Reduces energy consumption
- Reduces foam generation
- Reduces pressure drop
- Increases capacity



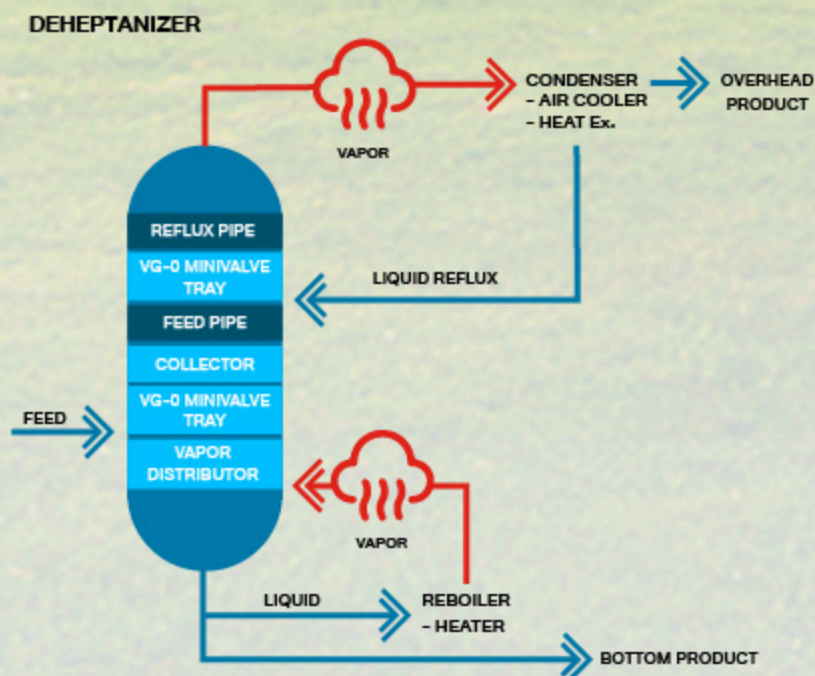
SUPERFRAC® High Performance Trays

The SUPERFRAC® tray is a high performance cross-flow tray that has the highest combined capacity and efficiency of all single-pass cross-flow trays tested at Fractionation Research Inc. (FRI)

- Advanced downcomer technology
 - Active area enhancements
 - Inlet area enhancements
- Increase capacity and efficiency

Case study#1

Column : Deheptanizer
7 % Increased capacity
12.60% saving



Case study#2

Quench Oil Tower
Plant : Olefin



Random packing :
Casocade miniring



Random packing :
Intalox Ultra

New generation high performance packing facilitates
13% additional capacity
36% reduction in overall pressure drop

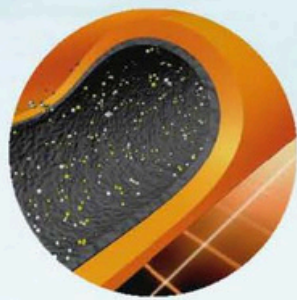
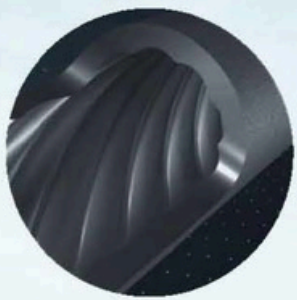
Radiant Coil SCOPE HT E

Longer Runs - Lower Coking Rates

Longer Runs
Lower Coking Rates



BARE TUBE

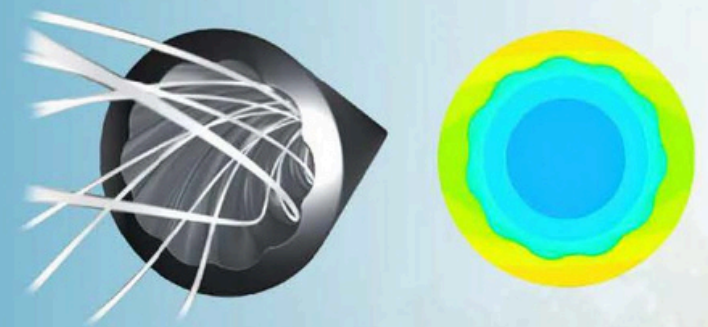


Rotating Flow Pattern

- Improved heat distribution across tube shell
- Reduced gas temperature gradients
- Balancing of sunny/shady sides
- Less carburization/maintenance
- Customizable profile (amount of fins & profile depth)

Performance

- **Increased run length** (lower TMT & coke formation) by factor of ~1.5 to 2
- **Higher product selectivity** (gas temperature balancing, less over-/undercracking) ~1% more olefins
- **Increased energy efficiency or higher feed rate/conversion potential** (higher heat transfer) ~3% fuel saving or ~+10% feed rate or ~+2% conversion (base on identical cooking rates)
- **Increase coil life** (Lower tube temperatures, less carburization)



Efficiency Improvement Standard Material vs HT E + SCOPE

CASE STUDY : Olefin Plant

