

CCR UPGRADE: REDUCING HAT FROM 120°C TO 30°C KEEPING EXISTING FOUNDATIONS BY USING STHE.

Presentation

Hengyuan Refining Company (HRC), situated in Port Dickson, Central Malaysia, operates a 0.6 MMTA Continuous Catalytic Regeneration (CCR) unit licensed by UOP started in 1988. To address issues of low efficiency and fouling with their existing tubular heat exchanger, HRC decided to upgrade their Feed-Effluent Heat Exchanger. They selected Spiral Tube Heat Exchangers, engineered and manufactured by Zhenhai Petrochemical Jianan Engineering Co., Ltd., to enhance the performance and the reliability of the reforming unit.



The Project

The project faced two key challenges: a limited maintenance shutdown time and a restricted plot space area for installing a new equipment. To overcome these, the new Spiral Tube Heat Exchanger (STHE) was designed to fit the existing exchanger foundations. The new design maintains the same elevation, orientation, and angle for the hot process nozzles, with only the elevation of the cold process nozzles adjusted to accommodate the new exchanger dimensions. The comparison between the two designs is given in **figure 1**.

The unit shutdown occurred in June 2023.

Within 10 days, the old exchanger was dismantled, and the new Spiral Tube Heat Exchanger (STHE) was installed on the existing foundations. Zhenhai Petrochemical Jianan Engineering Co., Ltd. (ZPJE) provided on-site supervision throughout the process, ensuring smooth installation and conducting training for the local operators both before and during startup operations.

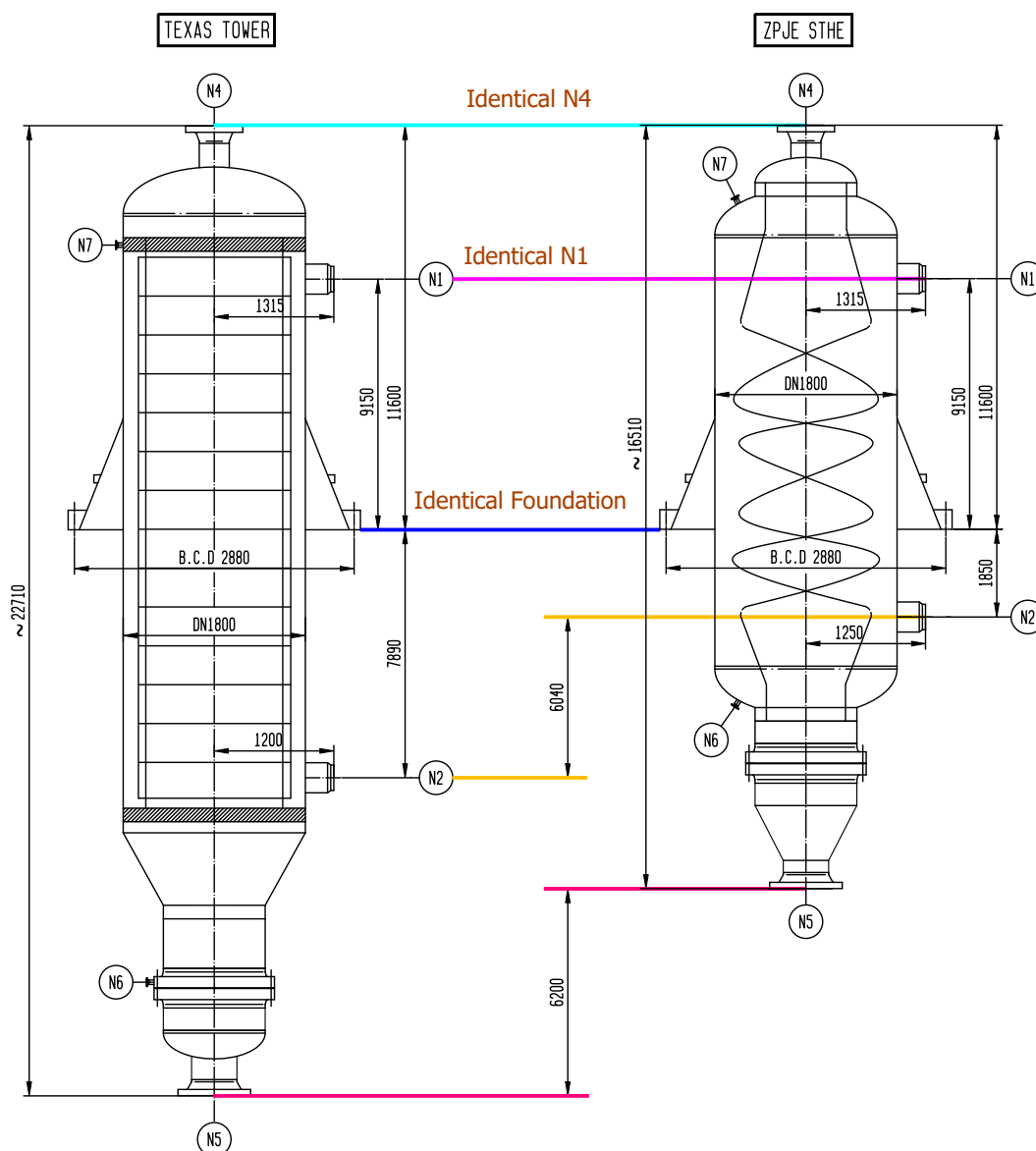


Figure 1 : STH and standard heat exchanger comparison.

Performance improvement

After the installation, and under similar process conditions, the Hot Approach Temperature was reduced by 93°C, coming from 121°C to 28 °C. Under these conditions, the fuel gas consumption was reduced by 18.1 MT/day, saving around 2.6 M\$/year.

Thanks to the better performance of the STH, the unit intake was increased to 1700 Ton per day when it was limited to 1600 Ton per day before the replacement.

The detailed technical and financial comparisons tables are given in table 1 and 2.



ZPJE

Creating Value for Our Customers

| Process Parameters | Before | After |
|--|--------|--------|
| Intake Naphtha (TPD) | 1558 | 1699 |
| N+2A | 73.6 | 79.4 |
| RON | 101.26 | 102.24 |
| Weighted Average Bed Temperature (°C) | 489 | 493 |
| Heat Exchanger Outlet Temperature (°C) | 349 | 452 |

Table 1 : Technical Comparison.

| Process Parameters | Before | After |
|----------------------------------|--------|----------------------|
| Number of exchanger | 1 | 1 |
| Hot Approach Temperature (°C) | 121 | 28 |
| Fuel Gas saving (TPD) | | 18.1 |
| Savings per annum ⁽¹⁾ | | USD 2,520,000 |

⁽¹⁾ : Considering Fuel Gas Price of USD 397/MT.

Table 2 : Financial Comparison.

Customer's satisfaction

After one year of stable and troubleless performances, here is what our customer is saying about our technology : «*The delivery time from placement of the order to the arrival to the refinery was 13 months. We needed 10 days to assemble the 750t crane plus 1 day for DOSH inspection. The dismantle and demobilization of the old exchanger took 7 days. Finally, the lifting and installation of the new exchanger took 3 days. No issues were faced to align the bolts on the existing foundations. The 30°C HAT performance is great, and we are getting technical support from ZPJE whenever needed. For after sales technical support, we are having quarterly data review by ZPJE, and tele conference meeting once per quarter to discuss about the STHE performances*».



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