Zhenhai Petrochemical Jianan Engineering Co.,Ltd.
镇海石化建安工程股份有限公司

ZPJE
Creating Value for Our Customers

CHEMICAL & MECHANICAL CLEANING OF SPIRAL TUBE EXCHANGERS IN REFORMING UNITS.

Presentation

Maintaining heat exchanger efficiency between two turnarounds is a critical factor in ensuring the long-term optimized yield of a unit. Variations in operating conditions and feedstock fluctuations can accelerate fouling, significantly affecting product quality. To mitigate this, heat exchangers should be designed to minimize fouling and allow for efficient cleaning of both the tube side and shell side. ZPHE Spiral Tubes Heat Exchangers (STHE) are engineered to address these challenges. Their unique design—characterized by high turbulence, the absence of dead zones, and low surface roughness—substantially reduces fouling tendencies compared to conventional technologies. Additionally, the tube side can be cleaned using both chemical and mechanical methods, while the shell side supports chemical cleaning.

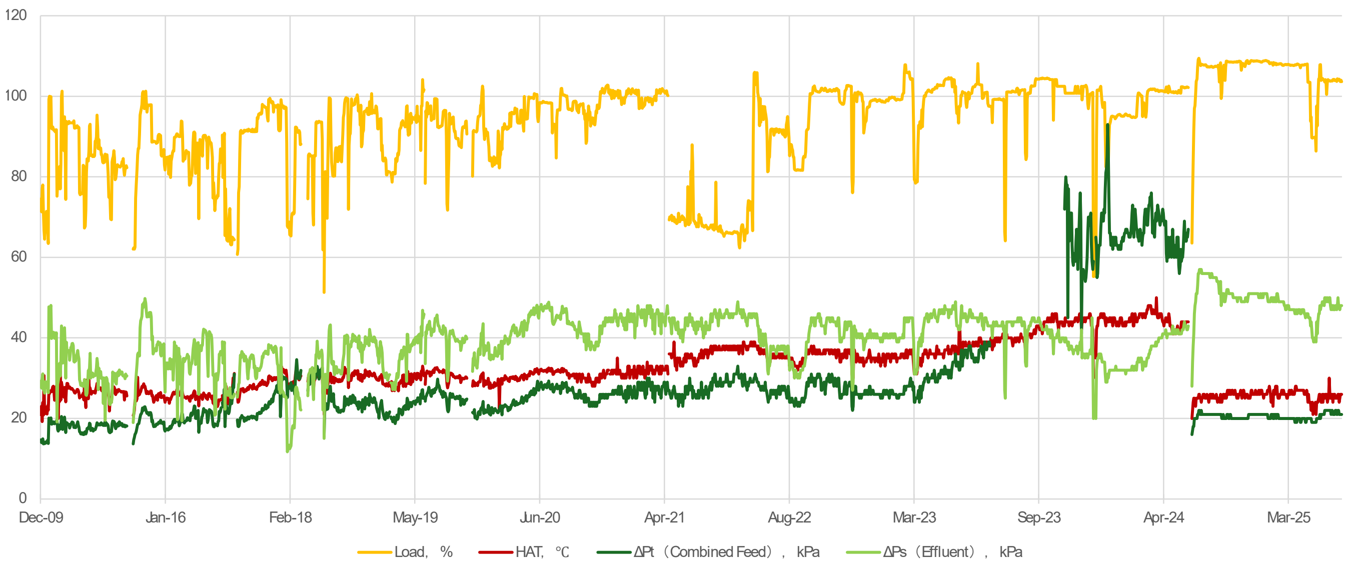
On-site maintenance for STHE can be performed by a standard local maintenance provider, following ZPJE's maintenance procedures and, if required, under the supervision of ZPJE service specialists. The maintenance duration depends on the exchanger size; however, typical cleaning times are as follows:

- Chemical and mechanical cleaning: Approximately 15 to 20 days
- Chemical cleaning only: Less than 7 days

Case Study

The Feed-Effluent spiral tube heat exchanger manufactured by ZPJE was installed in December 2009 in a 0.5 MMTA CCR unit. Over the 15 years of continuous operation, its performance has remained stable, with only a slight increase in pressure drop and Hot Approach temperature, which is expected in this type of fouling application.

In October 2023, a rapid increase in tube side pressure drop up was detected, reaching almost 80 kPa. This issue was effectively managed through the injection of a fouling inhibitor, which stabilized the pressure drop at an average value of 60 to 70 kPa.
By June 2024, the decision was made to clean the exchanger to restore the thermal and hydraulic performances of the exchanger.

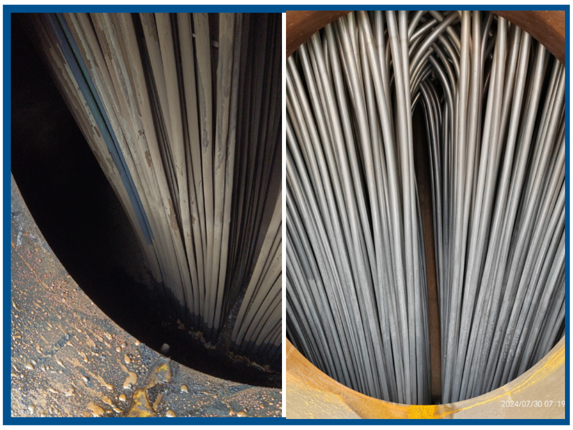


	Load (%)	HAT	DP tubes (kPa)	DP Shell (kPa)
Design Values	100	30.1	80 (Total allowable DP)	
July 2010	100	26.2	20.0	47.0
April 2024 (before cleaning)	101	43	65.0	42.0
November 2024 (after cleaning)	100	27.1	21.2	49.0

During the unit shut down and maintenance, the cleaning was performed on the tube side (mechanical and chemical) and on the shell side (chemical). The entire operation was completed within 18 days.
Following the completion of the cleaning and maintenance, unit operation was resumed with feed introduction starting at 9:00 AM on September 13, 2024.
The thermal and hydraulic performance was successfully restored at levels close to the initial startup, despite 15 years of continuous operations.

The following figures provide a visual comparison of the exchanger before and after cleaning.

Before and after cleaning pictures tube side



Before and after cleaning pictures shell side

Conclusion

The long-term efficiency of heat exchangers is crucial for maintaining optimized unit performance between turnarounds. As demonstrated in the above applications, ZPJE STHE offer a reliable solution for mitigating fouling and ensuring stable operation over extended periods. Their innovative design, which enhances turbulence and minimizes dead zones, significantly reduces fouling while enabling effective cleaning through chemical and mechanical methods.
The successful maintenance and cleaning of STHE in this case study highlight the ability to restore thermal and hydraulic performance even after years of continuous operation. These results reinforce STHE's effectiveness in optimizing heat exchanger reliability, minimizing downtime, and sustaining process efficiency in demanding industrial applications.

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