GTI SOLUTIONS

CASE STUDY | SUPERFRACTIONATOR REVAMP

Superfractionator Revamp Raises Purity While Reducing Reflux by 17%

An integrated process, equipment and site-execution solution increased operating margin within a highly constrained turnaround.

CLIENT: Confidential petrochemical producer | APPLICATION: Large petrochemical superfractionator

17%	~5%	PURITY	ON SCHEDULE
lower reflux	additional capacity demonstrated	requirement exceeded	turnaround installation

Executive Summary

A petrochemical producer needed to improve the separation performance and operating flexibility of a large, multi-pass superfractionator. The existing tray system delivered low efficiency, unstable overhead quality, valuable light-component losses and limited capacity in the lower section. Fouling and restricted access also made inspection and maintenance difficult.

GTI Solutions completed the process evaluation, hydraulic redesign, equipment engineering and supply, and the associated turnaround site work. The completed revamp exceeded the overhead purity requirement, reduced reflux by 17 percent and demonstrated approximately 5% additional capacity without reaching flood. The capacity demonstration was limited by available feed rather than by the revamped tower. A joint post-turnaround performance test conducted by GTI and the client confirmed results beyond the client's expectations.

The Challenge

The pre-revamp test run indicated calculated tray efficiency of approximately 66%, which was low for this close-boiling separation. Product-quality variability created downstream operating concerns, while light-component losses in the side draw reduced recovery. Deposits obstructed tray-deck openings, while the existing ECMD multiple-downcomer tray design did not incorporate manways, limiting access for thorough inspection during turnarounds.

The mechanical constraints were equally demanding. Because the vessel had undergone post-weld heat treatment, field welding to the pressure-retaining shell was prohibited. GTI therefore engineered the extensive internal modifications for installation without shell welding while ensuring that all critical work could be completed within the 33-day turnaround window.

GTI's Integrated Scope

GTI assumed an integrated scope from operating-data review through performance verification, allowing the process design, tray configuration and field-installation strategy to be developed as one coordinated solution.

- **Benchmarking and modeling.** Collected and reconciled operating data, established the baseline test-run performance, modeled the existing tower and evaluated six guaranteed operating cases.
- **Process and hydraulic design.** Optimized the tray count, spacing and section-by-section configuration; redesigned the feed inlet and distributing devices; and established performance guarantees for purity, yield and energy use.
- **Equipment engineering and supply.** Provided G-Frac™ high-performance cross-flow trays incorporating patented G-sF2 valve technology, feed hardware, internal supports and quick-remove tray manways for improved inspectability.
- **Turnaround site work.** Planned and executed dismantling of existing trays and internal piping, modification of internal support components, installation of expansion rings and new internals, and multi-zone workface coordination.
- **Performance testing and verification.** Planned and conducted the post-turnaround performance test jointly with the client, reconciled the operating data and verified the achieved purity, reflux and capacity results.

The Engineered Solution

GTI replaced the original multiple-downcomer trays with a section-specific G-Frac configuration. The design combined tray-deck enhancement, optimized downcomer geometry and patented G-sF2 valve technology to improve vapor-liquid contacting and flow distribution across the tray deck.

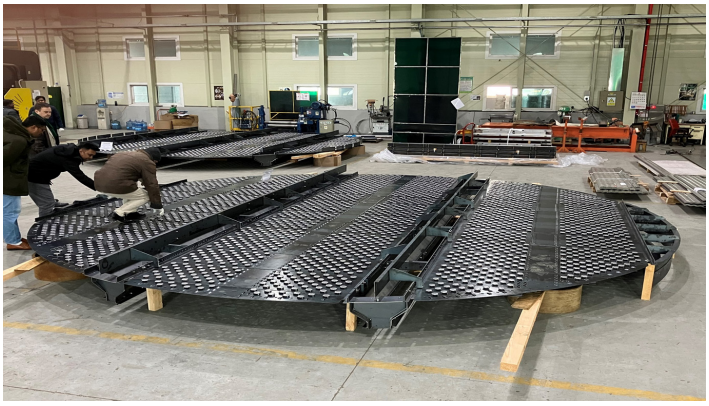
Rather than applying one standard tray geometry throughout the tower, GTI tailored the configuration to the hydraulic duty of each section. Tray spacing below the side draw was increased to create additional operating margin, while the upper section retained the stage count needed for product purity. The final arrangement achieved the required separation with fewer, higher-performance trays.

Quick-remove manways were incorporated in each tray pass so future inspection and maintenance could be completed more efficiently. The execution plan avoided welding to the pressure-retaining column shell; required modifications were concentrated on internal support components.

Turnaround Execution

GTI treated installation planning as part of the engineering solution. Trial assembly and tray mockup inspection were completed before shipment so site crews could confirm fit-up and become familiar with the installation sequence. When the turnaround schedule was delayed,

GTI implemented a long-term preservation program for the internals and restored them before installation.



During the turnaround, work was divided into coordinated installation zones. Existing trays and internal piping were removed, support elements were modified, new expansion rings were installed, and the high-performance trays and feed devices were assembled under GTI supervision. Despite the scale and complexity of the work, installation was completed within the planned turnaround. Following start-up by the client, GTI and the client jointly conducted the performance test.

Verified Results

Overhead purity exceeded the project requirement. The joint post-turnaround test run confirmed separation performance beyond the client's expectations.

Reflux was reduced by 17 percent. The reduction was achieved despite the lower final tray count, directly lowering reboiler and condenser duty.

Approximately 5 percent additional capacity was demonstrated. The tower remained below flood; further demonstration was limited by feed availability.

Installation was completed on schedule. Integrated engineering, mock assembly and coordinated site execution controlled risk within the restricted turnaround.

Maintainability was improved. Quick-remove manways and improved access simplified future tray inspection and maintenance.

The result: improved separation performance from the existing superfractionator, with lower reflux requirements and additional capacity margin.

Why the Revamp Succeeded

GTI approached the project as an integrated tower-performance revamp rather than a simple tray replacement. Process modeling, section-specific tray design, feed-device engineering, mechanical modifications and site execution were coordinated under a unified, performance-focused strategy. This integrated approach reduced interface risk and kept the client’s operating objectives aligned throughout engineering, fabrication, installation and joint performance testing.