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GLOBAL SERVICES, INC.

— MOBILIZE THE MISSION —

TECHNICAL PROJECT CASE STUDY REPORT

Exxon

Project: #630860

Asset: Shell and Tube Heat
Exchangers x2

Project Date: February 2025

Prepared By: Roger Connolly



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Overview

Frontline Global Services cleaned two shell-and-tube heat exchangers, achieving a final particle count of 16/14/11 or better. We used our High Velocity Flushing Unit (HVFU) and low-viscosity flushing fluid (FF-2020), flushing each exchanger separately to prevent cross-contamination. Screens were monitored throughout, ensuring API 614 standards were met. The exchangers were then returned to the customer with enhanced reliability and cleanliness.

Project Objectives

■ **Transportation & Setup:**

Pick up the heat exchangers from the customer's site, transport them to our warehouse, and prepare them for flushing operations.

■ **Flushing:**

Use the HVFU and armor-guarded stainless steel hoses to flush each heat exchanger individually, preventing cross-contamination.

■ **Cleanliness Standards:**

Achieve a final particle count of 16/14/11 or better, per industry standards (API 614), and ensure clean screens free of particulates.

■ **Speed and Safety:**

Efficiently minimize equipment downtime while ensuring all operations are conducted safely, protecting personnel and equipment.



Methodology

The team utilized High-Velocity Flushing Units (HVFU), FF-2020 cleaning agent, and armor-guarded stainless steel hoses to thoroughly flush each heat exchanger individually until cleanliness standards were achieved, effectively eliminating cross-contamination risks between exchangers.

Equipment & Materials

- **HVFU:** Designed for high-volume, high-velocity fluid circulation.
- **FF-2020:** Low-viscosity flushing fluid formulated for efficient particulate removal.
- **Armor-Guarded Stainless Steel Hoses:** Specialized hoses to withstand high flushing velocities and protect against damage.

Process

- **Setup:** The heat exchanger was connected to the HVFU using armor-guarded hoses.
- **Flushing Cycle:** The HVFU circulated FF-2020 at high velocity through the exchanger until cleanliness targets were met. Screens were inspected periodically.
- **Monitoring:** Particle counts were taken regularly. The flushing process continued until the screens were consistently clean and readings fell below the required 16/14/11 threshold.
- **Isolation:** Only one exchanger was flushed at a time to prevent any chance of transferring contaminants between units.



Project Milestones

February 11, 2025 – Equipment Pickup from Exxon Yard in Beaumont TX

Frontline picked up (2) exchangers and (4) 3" 150 flange x 3" NPT adapters at 4:30pm from Exxon Beaumont yard.



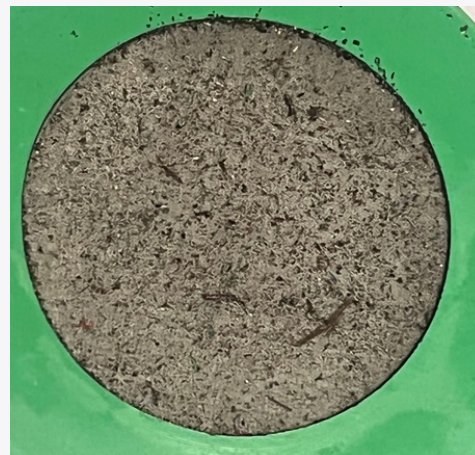
February 12, 2025 – Setup and Staging of Equipment





Project Milestones

The initial particle count of the FF-2020 fluid passing through exchanger 1102919-101 was recorded after bringing it up to temperature at 15:54. A 3" screen was installed at 13:15 and removed at 17:15 following a 2-hour initial screening. Upon removal, debris remained visible in the spool section, and the screen itself rated a 3 on our scale, indicating the presence of multiple metal fragments.

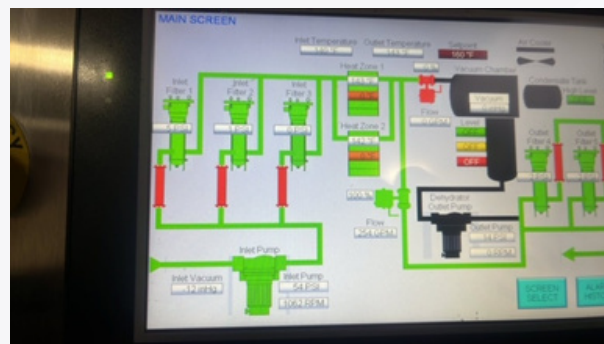


Below is showing the Flow rates and Pressures and temperature on our skid throughout the flush day and nighttime

Taken: 15:51 2/12/25



Taken: 18:05 2/12/25





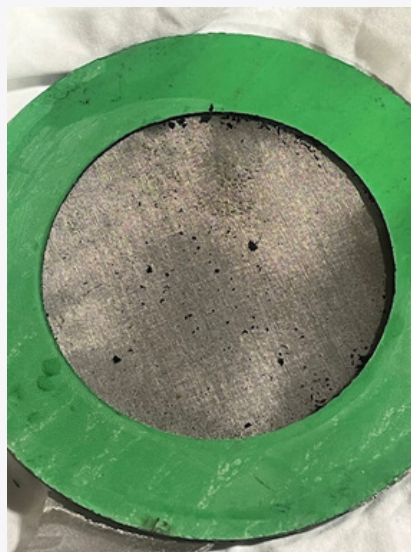
Project Milestones

February 13th, 2025

Particle count after 16.25 hours (taken at 07:36 on 2/13/25)



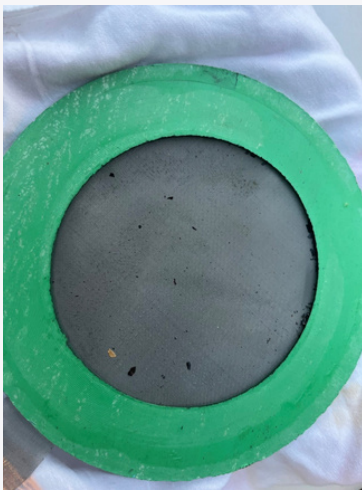
2nd 2-hour screen run from 07:30 – 09:30 on 2/13/25 rated a 2 on our scale with on metallic metal piece confirmed by a magnet





Project Milestones

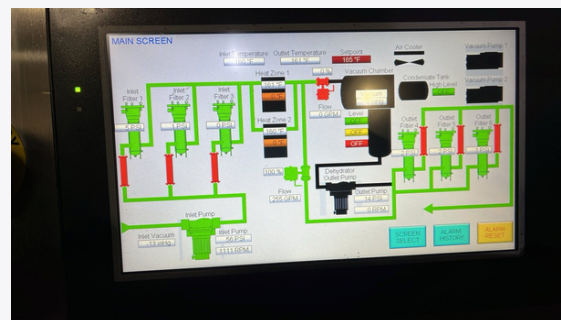
We installed a 3" screen at 16:00 for a 2-hour run to check progress of the flush. This would be close to the 25-hour flush mark. Also, we spoke with Alex on the urgency of needing these exchangers, he said Monday morning is good or whenever they are clean. 16:00 – 18:00 (2/13/25)



Taken: 17:52 (2/13/25)



Taken: 19:40 (2/13/25)

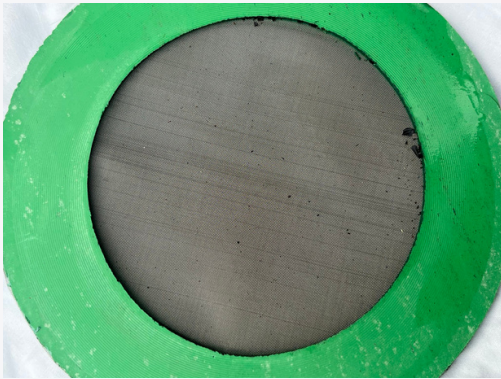




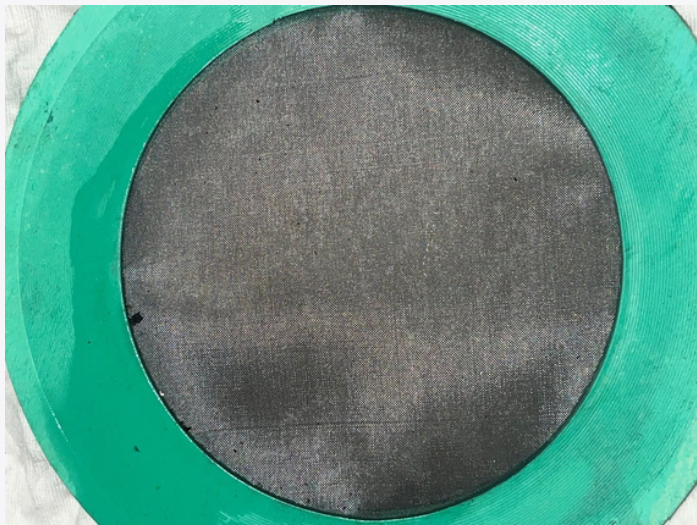
Project Milestones

February 14th

Screen installed at 07:15 for a 2-hour run.
(07:15 – 09:15) 2/14/25



Screen run from 14:00 – 16:00 - Exchanger S/N 11029199-101 was called
complete at 16:30 on 2/14/25

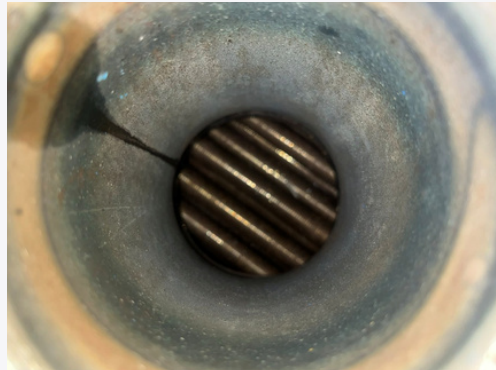
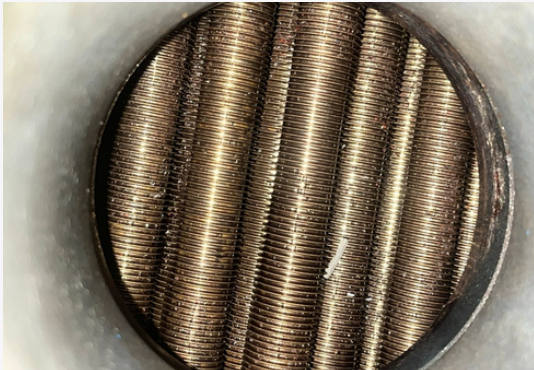




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Project Milestones

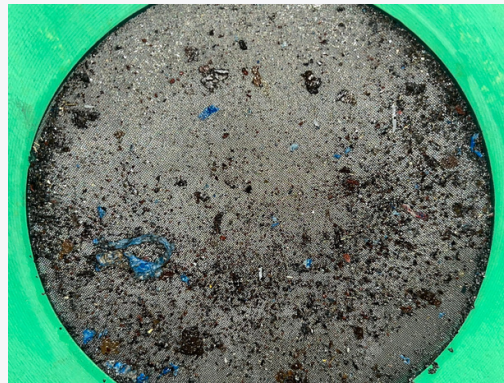
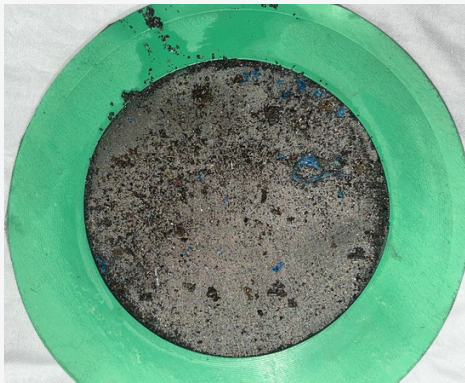
Inspection of exchanger S/N 11029199-201 (small exchanger) during set up





Project Milestones

Initial screen run from 17:00 – 18:00 (lots of metal and what looks like brass on the screen as well)



Initial particle count



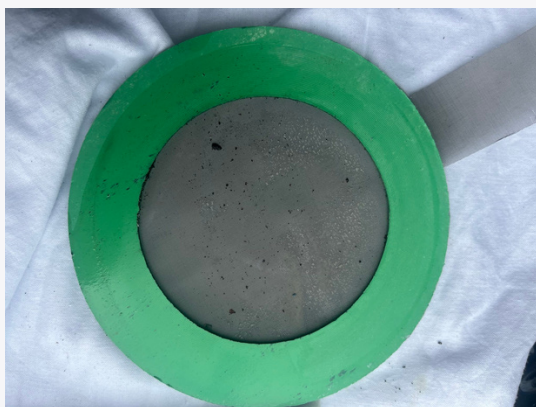


Project Milestones

Taken: 07:03 (2/15/25)



Screen run from 07:15 – 09:15 (2/15/25) lot of metal on screen still some did wash off and you can see a line from what washed off on the screen – 12 hours of flush time





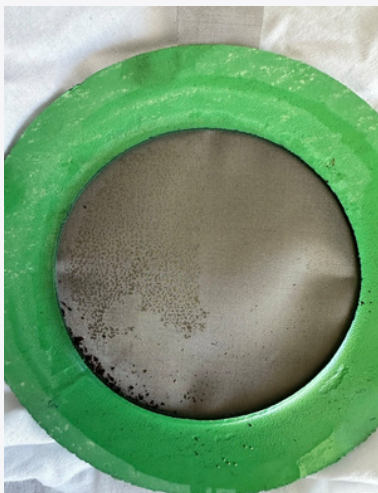
Project Milestones

February 16th

Taken: 10:04 (2/16/25)



Screen run from 09:30 – 11:30 on 2/16/25 – screen show metal still in system confirmed by use of magnet. We will continue to flush the small exchanger till tomorrow and then run another screen to check.





Project Milestones

The circled section is the metallic particles that moved around with a magnetic underneath the screen.



Due to the amount of metallic particles on the screen we ran another 24 hours on the small exchanger. This morning's screen was from 08:00 – 10:00. It didn't have any metal present on screen but did have a few hard particles but nothing major.





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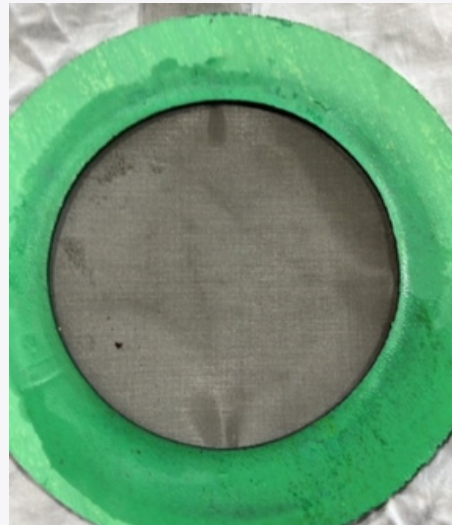
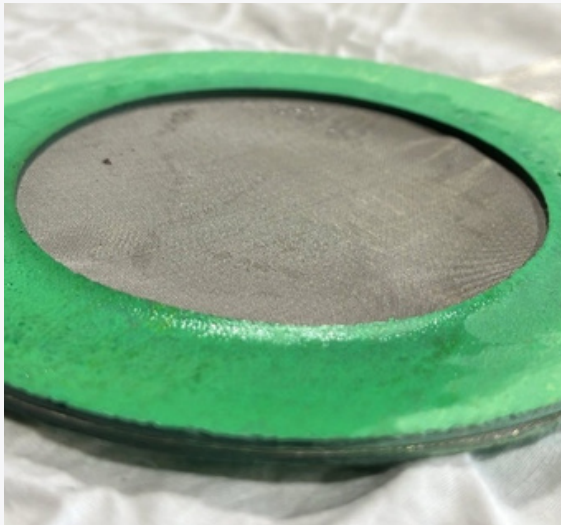
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Project Milestones

February 18th

Continued HVOF on exchanger 11029199101 with API Screens and ISO Particle Count Inspections

HVOF – 2 hour Screen run pulled at 12:30pm



ISO Particle Count 11/10/09





Outcome

■ Clean Screens & Particle Counts

The final particle counts for both heat exchangers were below 16/14/11, meeting and exceeding the customer's requirements.

■ Increased Equipment Reliability

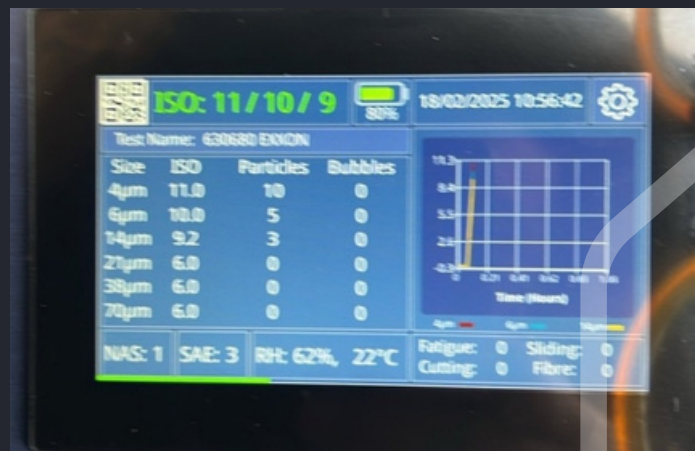
By removing built-up contaminants, the heat exchangers are now better positioned to operate at optimum efficiency and reduce the risk of downstream issues.

■ Fast & Safe

Timely execution, proven methodology, and delivery of a thoroughly cleaned and tested system satisfied our customer's operational and cleanliness standards, all done in a safe and fast manner.



Before Project: ISO (23/23/23)



After Project: ISO (11/10/9)



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Conclusion

Frontline Global Services successfully cleaned two shell-and-tube heat exchangers, significantly reducing contaminants to meet strict industry standards. Using specialized equipment and a meticulous flushing process, the project lowered particle contamination from an initial ISO level of 23/23/23 (high contamination) to an exceptionally clean ISO level of 11/10/9, surpassing the required cleanliness standard of 16/14/11. This extensive cleaning ensures the equipment will operate more reliably, efficiently, and safely, ultimately extending its lifespan and reducing the risk of operational issues. The process was completed efficiently, with careful monitoring throughout, resulting in improved equipment reliability, safer operations, and satisfied client expectations.

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