Clark•Reliance®
Purity Products Group

Improve Vessel Operator Safety and Reduce Confined Space Entry

It is generally accepted that the fine removal (≥ 0.3-micron) of aerosol droplets from natural gas requires the use of coalescing vessels and elements. Coalescing vessel design requires that the replaceable elements terminate well below the outlet of the vessel. In an average coalescing vessel with 10” inlet/outlet nozzles, the element hold-down nuts will be located approximately 30” from the vessel access closure. Servicing conventional coalescing vessels requires bodily entry of the operator into the vessel.

A confined space has limited openings for entry or exit, is large enough for entering and working, but is not designed for continuous worker occupancy. OSHA (U.S. Occupational Safety and Health Administration) uses the term "permit-required confined space" (permit space) to describe a confined space that has one or more of the following characteristics:

- May contain a hazardous or potentially hazardous atmosphere.
- May contain a material which can engulf an entrant.
- May contain walls that converge inward or floors that slope downward and taper into a smaller area which could trap or asphyxiate an entrant.
- May contain other serious physical hazards such as unguarded machines or exposed live wires.
- Must be identified by the employer who must inform exposed employees of the existence and location of such spaces and their hazards.

Individual site circumstances can influence the interpretation of the above. If you have questions on worker safety, you should contact OSHA at www.osha.gov (800) 321-OSHA (6742).

Servicing coalescing vessels used throughout the natural gas supply chain requires operators to enter vessels. Vessel entry creates safety concerns and liability due to the potential of operator entrapment. Bodily entry into a coalescing vessel meets permit required confined space criteria. In a vertical coalescing vessel, the operator must climb into the vessel and crouch down to access the hold-down nuts located below their

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feet. This crouched work position puts strain on the operators back and increases the potential for entrapment. Both horizontal and vertical coalescing vessels are generally classified as confined space.



Not only does this create an unsafe condition for the operator, but the operator's weight is supported by the element hold-down rods. The rods become bent and can cause improper element sealing.

In 2016, we received an inquiry from a customer that was having excess liquid carryover on their coalescing vessels. The source gas to their gathering station had changed and they were now seeing gas with higher liquid loads. The liquid carryover was contaminating their glycol contactor towers causing foaming. We had not supplied the vessels or the elements, but had solved some carryover issues for the customer at another location. After walking down the entire site and witnessing the change out of the coalescing elements, we observed the element hold-down rods were bent and misaligned due to operators climbing into the vessel. The bent rods were making it difficult for the operators to seal the elements. We had also observed the elements terminated at the vessel outlet. To reduce overall vessel height, some manufactures

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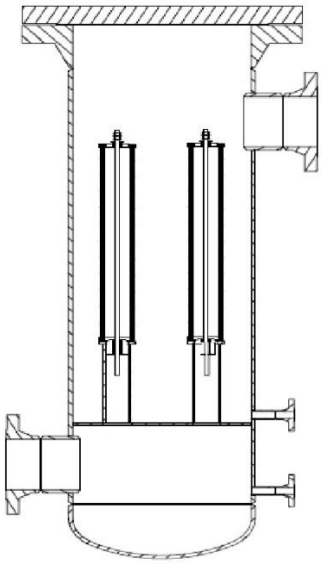
will terminate elements at the vessel outlet. This can contribute to excess liquid carryover.



We collected the vessel layout dimensions, the operating conditions, and a used coalescing element. We did our sizing calculations and found that the existing vessel contained more elements than required for the gas flow. The extra elements increased the annular velocity in the vessel. Increased annular velocity can contribute to excess liquid carryover.

The termination of the elements compounded with the increased annular velocity was creating the bypass condition. Our team proposed replacement of the existing vessel or shortening the elements to increase the freeboard space from the element termination to the vessel outlet. We were able to reduce the element height due to the relatively low face velocity of the coalescing elements. Our team developed the VertexCore, a nonpermeable core extension. The nonpermeable extension allow for a lower positioning of the element termination with elimination of bodily entry into the vessel.

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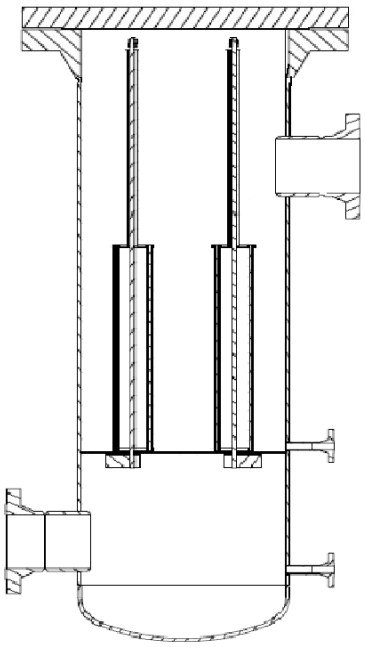

An R&D project was initiated. It was determined that field testing would be required. Field modifications of the vessel hold-down rods were required. Custom elements with enhanced capacity per square foot of media were designed. Extended core elements were prototyped. Vessel adapters and rod extensions were fabricated.

Working with the customer, it was determined that two amine trains would be isolated and compared. The trains received gas from the same main header, and it was estimated that the gas quality would be generally similar based on the piping layout. One would receive our modifications and the other would use the existing supplier.

Liquid collection volumes would be tabulated. The comparative operation of amine towers was noted each shift. The customer defined our success as no foaming on our train when foaming was present on the other train. After 4 months of operation, the train with the extended core elements out preformed the conventional elements.

The VertexCore solution eliminated the need for the operators to climb into the vessel and eliminated the carryover issues.

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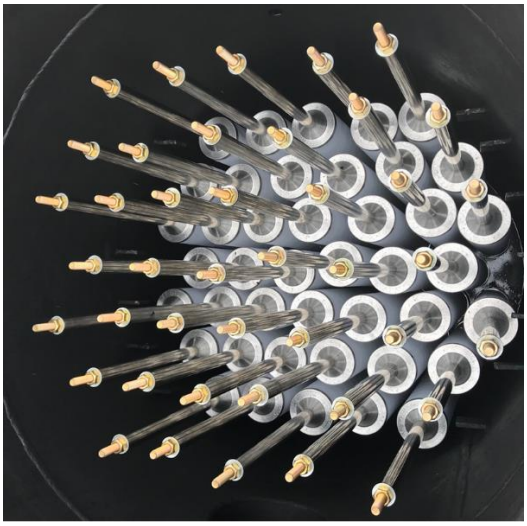
Before

After

Before

After



Author Profile: Tom Lisy, Corporate Sales Manager of the Purity Products group. Within the Purity Group, he oversees the sales, engineering, and R&D. He has worked in the filtration industry for 25 years and holds Four US Patents for filtration devices.

For more information, visit http://crfiltrationsolutions.com/ or fill out the contact form here.

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