TECVALCO CWT-VHT-DUAL

SYSTEM DESCRIPTION

JAN 17, 2017

BACK GROUND:

The former Grit Industries installed the first Vertical Heater Treater system in April, 2015 in North Dakota, USA. The system utilized a single CWT-770 boiler coupled to a custom designed multi-tube steam bundle which replaced the less expensive conventional Fire Tube Burner system traditionally employed to heat oil emulsion for separation. The system removed the ignition source from the vessel and the dangers associated with it, reduced the volume of gas required to run the process, provided a uniform and responsive low temperature heat source, and allowed the water/oil interface level to be lowered to allow for direct heating of the oil. The low temperature operation also allows the exchangers coating to operate within temperature specifications. Fig.1 below shows the initial installation. Sizing calculations based on well data, have since shown that a typical 6' treater requires a CWT-385 boiler.

Fig.1

Since April, 2015, there have been more than twenty Tecvalco-VHT systems installed in the Bakken oil fields. Fig.2 shows a multiple installation.

Fig.2

Tecvalco recognizes the challenges production companies face when trying to rationalise the capital cost of a CWT-VHT system as compared to the conventional fire tube. In an attempt to reduce capital cost it was suggested to look at the possibility to heat two treaters with a single boiler unit. This would reduce the boiler capital by using a single CWT-770 as opposed to two CWT-385 boilers. Although there is a significant reduction between the boiler costs, part of the savings will be consumed by valves and controls.

The process for controlling dual exchangers from a single CWT requires a simple change to the operating parameters used for a typical single system. Using one boiler per exchanger allows the vessel temperature to control the main burner function of the boiler. As the vessel reaches the set point on the capillary based temp controller, the contacts open shutting off the main burner. In order to operate two exchangers with a single boiler, each vessel temperature probe would control the opening and closing of its respective steam valve. This would require the boiler to be controlled solely by its own pressure control. The boilers max pressure (temperature) would be set on the operator pressure switch. If both vessel valves were closed (ie, both vessels at temperature) the boiler temperature (pressure) would continue to raise to the set point. When reached, the main burner would turn off and only turn back on when the boiler has cooled enough to reset the pressure switch based on differential pressure setting. This means the boiler would always operate within a narrow band of temperature regardless of the load required from the vessels.

To help reduce the costs and simplify the controls, a single valve per vessel would be used to only block the flow of steam the exchanger. The condensate line would remain open to allow any residual condensate to drain back to the boiler without allowing any significant amount of heat to cycle to the tube bundle due to the line being flooded at the boiler end.

Plumbing the dual system will require some different approaches. With a single system, the condensate line is sloped towards the boiler for drainage but the supply line is kept level or sloped slightly to the exchanger to allow the steam to push any condensate forward to the exchanger. Since the dual system will have a valve installed directly at the supply flange of each exchanger, (see Fig .3) and the two supply

lines and two return lines will be tee'd into single supply and return lines from the boiler, the system will look as depicted in Fig's 4 through 6.

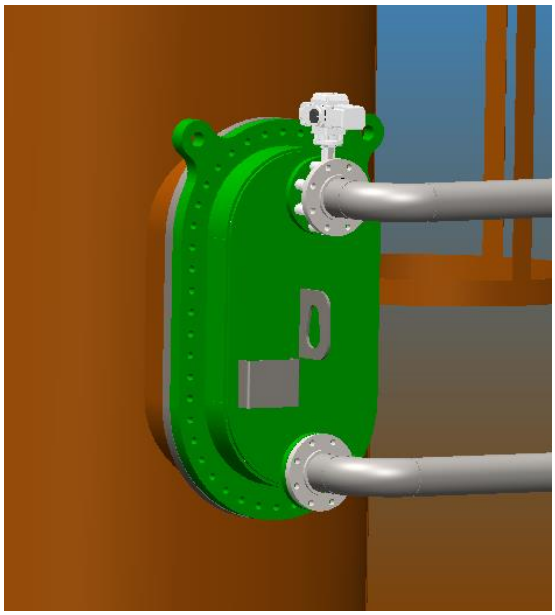

Fig. 3 Valve Mounting

In order to prevent condensate from collecting on the boiler side of a valve when the valve is in the closed position, the joining line between the vessels, for both the supply and return lines, will need a 1" drop for 10' of run from the exchanger to the center tee. The common lines from the tee joints back to the boiler will also require a minimum 1" drop per 10' run, for positive drainage to the boiler in all conditions.

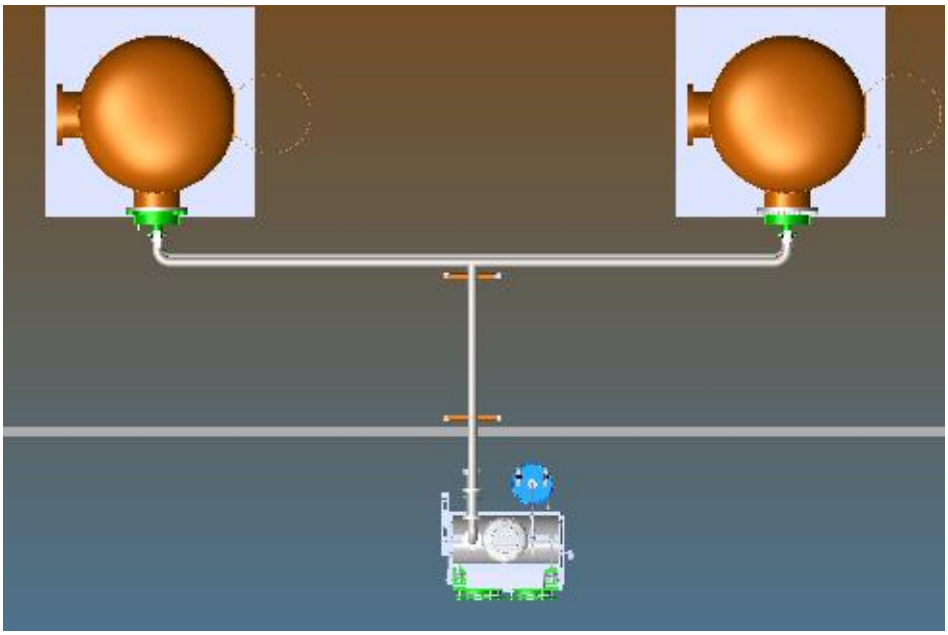

Fig. 4 Top Elevation View

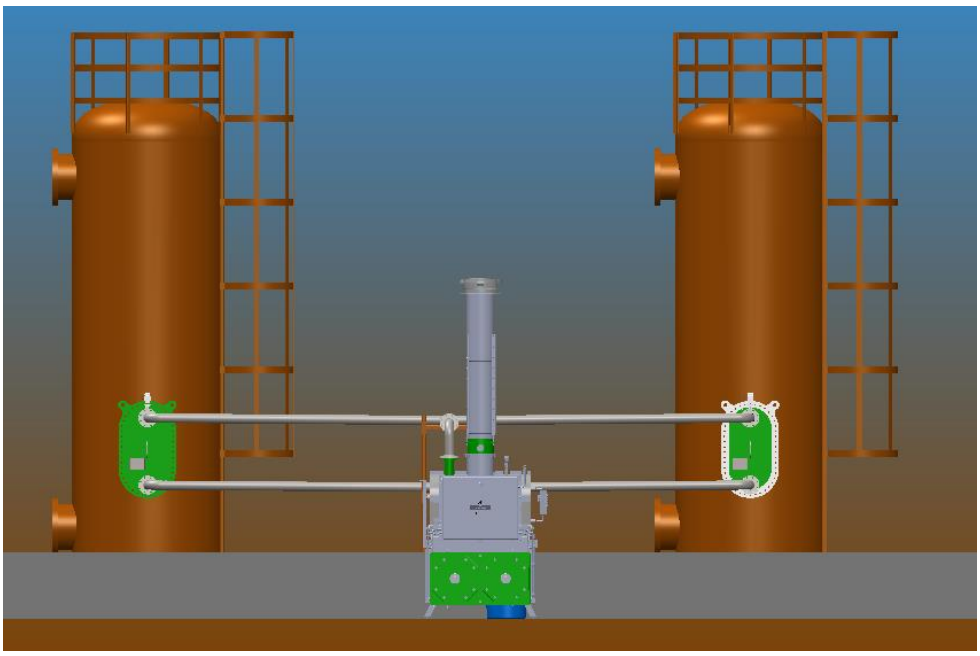

Fig. 5 Front Elevation View

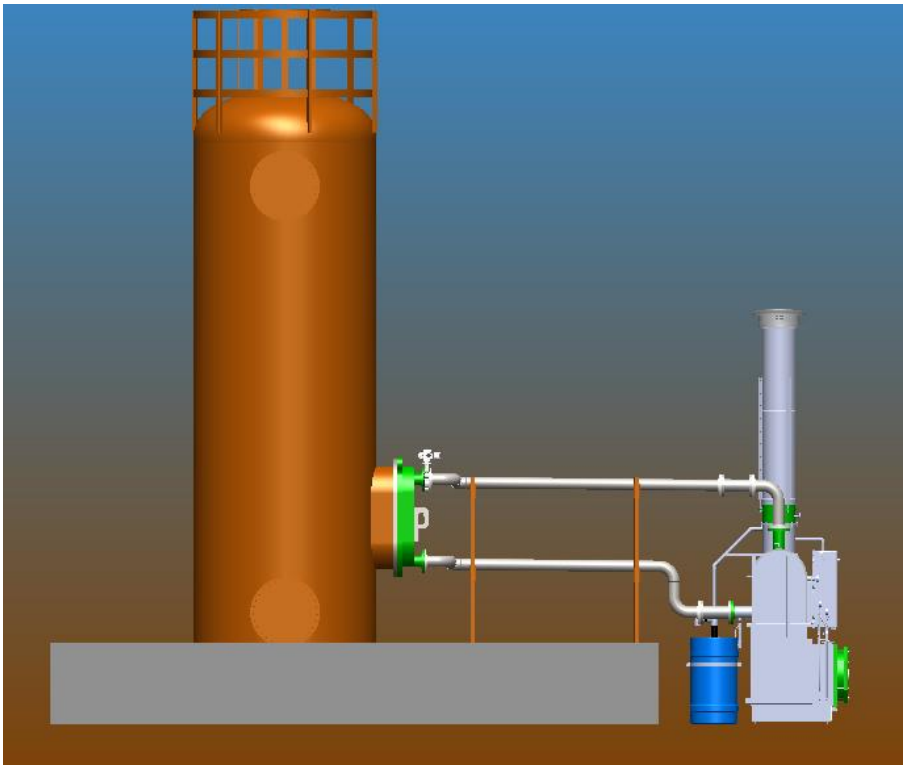

Fig. 6 Side Elevation View

CONSIDERATIONS:

The only significant weak link in this proposed system is the actuated valve. Traditionally the CWT product line only uses valves as a means of isolation for service in heating systems utilizing more than one boiler feeding a single exchanger. This system is very common in the natural gas utility market and can be seen in Fig 7 below. This valve is installed and left in the open position until such time as it may need to be closed to isolate a particular boiler for service, while still allowing the system to operate. The majority of the valves installed in the past have never been closed or cycled. The task of finding a suitable valve that will not only have a seat capable of holding full vacuum, but also will have stem seals that will maintain a vacuum has proven difficult but not impossible. In the case of the VHT system, the seat integrity is not as important as the stem seals. If when closed, the valve seat continues to leak a small amount of steam to the exchanger, it will not affect the system since the return line is open and can always drain any condensate to the boiler. The amount of steam will not be sufficient to overshoot the vessel temperature set point. The stem seal will be the predominate factor as the valve will cycle on and off for the vessel to maintain the set point. This cycling cannot cause any significant wear on the stem seals or the system will lose vacuum in a relatively short timeframe. Tecvalco has sourced a vacuum rated butterfly valve but has yet to test for longevity.

Fig. 7 3.85 mmBTU Natural Gas Line Heater

The following table presents the variations between the two systems in order to better capture all the potential savings of the new CWT-VHT-DUAL.

CWT- VHT	CWT-VHT-DUAL
2 ea CWT-385-BOILER, 2 ea VHT-6' EXCHANGER	1 ea CWT-770-BOILER, 2ea- 6' VHT EXCHANGERS
2 sets helical piers and pier caps	1 set helical piers and cap
2 fuel gas feeds c/w gas conditioning	1 fuel gas feed c/w gas conditioning
Approx. 30' piping per system, 60' total	Approx. 80' piping
160" weld for piping per system, Total 320" weld	370" weld
	2 ea 4" Actuated, 24vdc BF valve, Vacuum Rated
	1 ea 24Vdc control, c/w power supply and relays

Please see the attached PDF drawing, CWT-VHT-DUAL for a general layout and description.