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TANK INSULATION PANELS



Rebecca Mayes, MC&I Inc., USA, recommends mechanical insulation

systems to lower energy costs in the downstream storage industry.

echanical insulation is vastly overlooked as a solution to lowering energy costs across all industries. Mechanical insulation systems are among the few manufactured products that save more energy than it takes to produce them. The National Insulation Association estimates that over a 20 year lifespan, mechanical insulation systems can save between 140 and 500 times the energy it takes for manufacturers to produce them.¹ The payback on initial investment is often within a few years.

Insulation has long been recognised as a low-cost method of conserving natural resources. What is not as well known is that insulation is considered a sustainable technology. In fact, insulation can be considered effectively "greener than trees", according to Glenn Frye, President of the National Insulation Association.² Within the downstream oil, gas and petrochemical storage industry, storage tanks located in terminals are typically temperature controlled and utilised on a continuous basis. Insulating a storage tank provides multiple benefits such as condensation control, process efficiency, freeze protection, and energy conservation. Thermal insulation will reduce the necessary energy used in tank heaters and will ensure proper tank equipment functionality by providing more consistent temperature fluctuations.

When it comes to tank operators choosing a system, there are several insulation system options for storage tanks and vessels, such as spray foam insulation, conventional or horizontal wrap insulation, or a pre-manufactured vertical standing seam panel insulation system (VSSI). Depending on the environment, tank contents, and the required operating temperatures, some



B) METAL: .024" THICK STUCCO EMBOSSED ALUMINUM OR AS SPECIFIED
C) DOUBLE FOLDED VERTICAL STANDING SEAMS
CABLE: .25" THICK STAINLESS STEEL CABLES SPACED AS SHOWN
E) BANDING: .50" W X .015 THICK STAINLESS STEEL BANDING
F) STRANDVISE CABLE CONNECTORS
G) CAULKING: (TYPE BASED ON OPERATING TEMP)







TIE DOWN STRAP-STANDING SEAM CONNECTION

Figure 2. Standing seam connection for the RIDGLOK VSSI panel system.

systems may be a better fit than others. Application of spray foam is limited to operating temperatures under 180°F and requires consistent maintenance to ensure the exterior coating is still intact. Without a proper maintenance programme, rodents, birds and mould can deteriorate the insulation. Traditionally, the conventional or horizontal wrap insulation style has been utilised by engineers across the industry. The most common insulation material being used is mineral wool, which has a good fire resistance, fair thermal value and a difficult and lengthy installation is required using costly scaffolding and welding of structural supports. The insulation is then wrapped with corrugated metal sheets and secured with an external metal band, exposing the connection to environmental temperature fluctuations that could lead to breakage and failure over time. These methods of insulating storage vessels have proven over time to have drawbacks, such as high maintenance needs, wind speed limitations, water infiltration and problematic repairs.

The VSSI concept was developed in the US to answer challenges resulting from specific meteorological constraints generated by high wind storms and heavy rains, as well as for geographical areas with higher than average wind speeds. The VSSI system is engineered to meet the strictest project specifications and is the latest in storage tank insulation technology. The system has low maintenance and a long lifespan.

The attachment system is internal to the insulation panel, which provides protection from adverse weather conditions (Figure 1). The double folded standing seam is mechanically sealed to lock panels together to protect the insulation material and the internal attachment system (Figure 2). This method helps to ensure system longevity of 25+ years. With the conventional or horizontal wrap insulation, the edges of the metal jacketing are connected with screws and external banding, potentially allowing moisture to infiltrate the system over time.

The wind speed capability is engineered upon the spacing of the internal cable attachment system, and with a standard attachment cable spacing on the shell and standard conical roof design, the average wind speed capacity is 95+ mph.

In comparison to traditional methods, versatility is an advantage the VSSI has over other tank insulation options. The system can be engineered to incorporate various material choices for all types of storage tanks and roof designs. For operating temperatures under 250°F, a non-fibrous, non-wicking, closed cell insulation is utilised for superior R-value and moisture barrier. Polyisocyanurate (PIR) has a superior compressive strength over mineral wool or fibreglass that will not degenerate over time, contributing to a better performance with a longer lifespan. If the operating temperature is over 250°F, a composite panel is manufactured with an inner layer of mineral wool or fibreglass with an outer layer of PIR to give the panel structural stability for installation purposes.

The process in which the VSSI system is installed is more time-efficient than other methods of tank insulation. Due to the engineering and prefabrication being completed prior to shipping the system, installation crews in the field spend less time onsite and need less man power to install than conventional tank insulation methods. The system is typically installed using an aerial man-lift, unless a tight restricted area would require scaffolding or an aerial spider basket to obtain access. Conventional insulation systems require the use of scaffolding in order to install the horizontal rings and require a significant



Figure 3. A VSSI asphalt storage tank application.



Figure 4. Congested workplace during installation.

amount of welding to the shell. For the VSSI system, welding insulation supports are not required on the shell of the tank; only welding the roof attachment system would be necessary if the tank was a welded design.

Maintenance costs are minimal on the prefabricated VSSI system, with only the caulk seals around the tank penetrations needing periodic inspection. If the insulation needs to be repaired, retrofitting or replacing a single panel is easily accomplished, rather than removing the entire horizontal ring of a conventional insulation system.

The following is a case study that shares the benefits of insulating a storage tank and the advantages of utilising the latest technology in less than optimal workspace conditions.

Case study

CountryMark is an American-owned oil exploration, production, refining and marketing company with a complete line of premium quality liquid fuels, beginning with light, sweet crude oil, which is refined to the highest specifications at the company's refinery in Mt. Vernon, Indiana. Fuel quality is protected as it travels north along a 238 mile private pipeline. State-of-the-art blending technology at each company fuel terminal ensures that biodiesel and ethanol blended fuels are formulated for optimal driving performance and winter operability.

Project specifics

Asphalt must maintain a constant operating temperature (on average 350°F) for optimal process control. The tank in question was a 45 ft dia. x 35 ft high welded asphalt storage tank. Insulating this type of storage tank provides fuel savings, conservation of energy, diminished heat loss, and gives a more appealing look to the tank. Heater performance life is typically extended due to lessened load by reducing constant heating and reheating.

The VSSI system was designed with 0.024 stucco-embossed aluminium metal jacketing in white, laminated to a composite panel using fibreglass and PIR insulation for a total R-value of 14.7. The inner layer adjacent to the tank shell must accommodate the storage vessel's maximum operating temperature of 350°F. Once the inner fibreglass layer of insulation brings the temperature down below 250°F, the outer layer of insulation can be laminated to polyisocyanurate of a different type. PIR is a more rigid insulation board than fibreglass, giving the exterior metal sheathing a stronger material to bond to for the best aesthetic exterior.

The challenge

The asphalt storage tank scheduled to be insulated only allowed minimal working space and included multiple protrusions, as the piping adjacent to the pump house and stair casing made for a congested workspace around the tank perimeter.

Solution

Using the VSSI panel system eliminated the need for scaffolding the tank, because the installation crew utilised an aerial man lift to reach over the congested area. The project was completed successfully, finishing six days ahead of schedule while maintaining time efficiency and quality of the tank insulation installation.

Post-project performance

One year later, the client reported that due to the system performing so well, their engineers wrote the VSSI system into their engineering specifications for another storage tank insulation project the following year. As a result, the client will have minimal maintenance on this insulation system compared to the conventional insulation system installed on the adjacent tank from the VSSI panel system project.

Conclusion

As tank insulation technology has developed, the focus has turned to systems with longevity and reduced maintenance. The days of long installation times, complications due to workspace, multiple penetrations and safety concerns have been minimised in today's evolution of tank insulation. The VSSI panel system is transitioning to engineering specifications across all industries as engineers understand the numerous advantages of the system compared to spray foam insulation and conventional or horizontal wrap insulation systems. The VSSI panel system has been proven over the years to have the highest return on investment due to the long lifespan and low costs of installation and maintenance. Whatever type of project, collaborating with insulation engineers is crucial to maximising the energy efficiency of a facility.

References

- 1. National Insulation Association, Brochure, p. 2.
- CRALL, C. P., 'Insulation: Greener than Trees!', National Insulation Association, (1 January 2009), http://insulation.org/io/articles/insulationgreener-than-trees/.

