LPG Railcar Unloading

APPLICATION DOCUMENT

As the number of governmental initiatives demanding increased use of cleaner fuels grows, the demand for liquefied petroleum gas, or LPG, is also expanding. Nearly two-thirds of LPG is extracted from natural gas, while the rest is a byproduct of crude oil refining.

Despite being produced from fossil fuels, LPG is becoming a favorite among environmentalists because it releases less carbon dioxide (CO_2) per unit of energy than oil or coal. LPG also burns cleaner than other hydrocarbons because it releases fewer particulates during the combustion process.

As the popularity of LPG continues to grow in regard to its use as a feedstock for cooking, heating and motor-fuel purposes, transporting it to the end user takes on greater importance. Today, the most common method of LPG transport from the refinery to the storage terminal is by railroad via trains featuring upwards of 100 LPG-laden railcars each carrying an average of 33,500 gallons (126,811 liters)

The challenge when these trains arrive at the LPG terminal is offloading the product in the safest and most time- and cost-efficient manner possible. Most LPG offloading is done through a closed-loop system that connects to the top of the railcar. The unloading process is accomplished by pulling gas out of the storage tank, compressing it, and using this gas to push the liquid LPG out of the railcar into the storage tank. When the liquid-transfer process is finished, any remaining liquid is boiled off and the residual vapor is pulled down in a vapor-recovery process, leaving an empty railcar that is ready for its next load. If offloading speed is optimized, this process generally takes four hours. Note that this process is applicable for more than LPG; anytime a liquefied gas, such as refrigerants, CO_2, anhydrous ammonia, etc., uses a top-unloading connection, this closed-loop process will be applicable.

Centrifugal pumps are one form of technology that can be used for LPG transfer as they are able to create the high flow rates required, at least at the inception of the unloading process. However, as the internal head pressure in the railcar decreases, the pump's ability to maintain a high flow rate deteriorates to the point that it will eventually stop operating, leaving a significant amount of LPG in the railcar. This makes compressors a better choice for LPG-railcar evacuation, but only if an oil-free model is used. Lubricated compressors run the risk of crankcase oil entering the LPG stream, which will contaminate it and compromise its integrity.

Taking these operational concerns into account, a better choice for unloading an LPG railcar is a Blackmer® Reciprocating Gas Compressor, specifically the LB Series models. The LB600 and LB940 models are recommended for LPG offloading because they can produce the high flow rates (up to 680 gpm/2,575 L/min) needed for optimized performance. Their oil-free non-lubricated design eliminates the need for crankcase oil that can mix with the LPG. All LB Series compressor models feature pressure parts constructed of ductile iron for greater resistance to thermal and mechanical shock, while being designed for easy maintenance with all components readily accessible.

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COMPETITION

- **Centrifugal Pumps**

When the railcar is full and the head pressure is at its highest level, centrifugal pumps can be a workable solution. However, as the car is emptied and the internal pressure decreases, the pump will cease working, leaving a significant amount of LPG in the tank that still needs to be removed.

- **Lubricated Compressors**

Lubricated compressors can deliver the same levels of performance as non-lubricated models, but they run the risk of the crankcase oil entering the LPG stream. When this happens, the LPG becomes contaminated, which compromises its integrity.

FROM THE FIELD

An LPG supplier in the Upper Midwest with a growing customer base needed to expand its bulk-storage capabilities in order to meet the higher demand. The solution was to build a new LPG storage and transfer facility complete with a rail spur that would allow LPG-laden railcars to dock so they could be unloaded into the site's bulk-storage tanks. The plans called for eight storage tanks to be installed, which would give the facility a total storage capacity of 300,000 gallons of LPG.

The setup of the terminal required each of its three rail towers to have a compressor situated on it. At each tower, a Blackmer® LB601 Series Reciprocating Gas has been installed. The LB601 compressors are ideal for the terminal's LPG railcar-unloading operations because they offer an oil-free design with the unique ability to do both liquid transfer and vapor recovery after the railcar's payload is emptied.

The LB601 compressors feature ductile-iron construction that make them stronger and more resistant to thermal shock than cast iron, resulting in long-life reliability. Leak-free operation is ensured by the presence of O-rings, instead of gaskets on all of the pressure-containing parts. Case-hardened steel valves and stainless-steel discs and springs are easily removed without having to disturb the piping. Finally, the suction valve can be configured as either an input or discharge valve, which simplifies the stocking of spare parts. The modular design of the LB601 compressors also simplifies the stocking of spare parts.

Most important, LB601 compressors enable optimized LPG-unloading times; what was once a seven-hour process to unload one railcar can now be completed in less than five hours. These optimized flow rates, as well as improved vapor-recovery capabilities, have improved the operation's overall efficiency and profitability.

For more information on these additional solutions, visit us at blackmer.com.

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