Compression Leasing Services Inc. has developed a Cummins-powered, trailer-mounted unit designed to operate anywhere high-pressure air, high-pressure water or foam injection is needed. The trailer is equipped with integrated hand rails and stairs for access to the equipment.

VERSATILITY IS KEY FOR COMPRESSION LEASING SERVICES

New Unit Targets Air, Gas and Nitrogen Compression Applications with a Single Trailer

By Brent Haight

Compression Leasing Services Inc. is in final testing of a trailer-mounted unit designed to operate anywhere high-pressure air, high-pressure water or foam injection is needed. The Casper, Wyoming, U.S.A.-headquartered company has taken functions typically accomplished by multiple trailers and combined them into a single, self-contained, 76,600 lb. (dry) (34,745 kg), 53 ft. (16 m), four-axle steel-decked trailer that can be set up and operational in about 45 minutes.

"This is a complete air drilling package, or a foam cleanout package, or just a screw compressor and a booster because you don't have to run the pump," said Ben Gruner, president of Compression Leasing Services. "This is a very versatile machine. It can compress air, nitrogen or natural gas."

According to Gruner, the trailer was three years in the making. "We've put a lot of engineering time in this and incorporated a lot of suggestions from customers. Many offerings from other manufacturers typically fall in the 900 to 1350 cfm [25.5 to 38 m^3/min] range to 1500 psi [103 bar], with a smaller pump as well, but our customers wanted more. We've built a lot of trailer units over the years, but never anything capable of doing everything from one trailer. We have boosters and pumps on trailers, but we never had a screw compressor, a booster and a pump on the same trailer because we could never fit it all and accomplish the flows and pressure our customers desire. The volumes and the pressures always required two trailers. A lot of people were asking for one trailer with over 2000 cfm [57 m^3/min] at over 2000 psi [138 bar], but it had never been done. My brother took on the challenge to design a single unit and succeeded."

The fully integrated trailer air package utilizes three Cummins engines.

"Cummins came to the table and really helped us out," said Gruner. "Designing a product like this is difficult. We invested a lot of man-hours in this and Cummins was an active partner on the engineering side."

"There was a lot of cooperation between our engineering groups," said Joe Becko, vice president Industrial/Oil & Gas Marketing at Cummins. "There is a lot going on here. With all the subsystems, air handling, fuel and cooling systems, it's pretty complex. We also tried to make sure all the air cleaners were the same for ease of serviceability. A project this big really requires a partnership to make this thing work."

The concept of the unit started with the cooling system.

"Most trailer units tend to rely on a variety of coolers that blow hot air all over the place, including on each other, reducing performance," said Gruner. "Often, one engine will cause a problem for another engine because the airflow is messed up. We built a centralized cooling unit to address that and then built the package around it."

According to Gruner, one of the most difficult parts of this project was to provide the cooling required for the increased flow in the limited space of the trailer system. This was completed using a combination of dif-

A view of the Superior C-Force three-stage, four-throw booster compressor frame and cylinders.

(Left) Each of the three engines are integrated into a single operator station that can be operated from the ground level. (Right) A view of the spark-arresting muffler on the QSX 15 Cummins engine and the overspeed/air shutoff valve.

ferent types of cooling sections attached to a plenum and fan arrangement custom made by Compression Leasing Services. The cooling system utilizes the two large engines to drive fans, but allows each unit to be run independently without the others. Cool air is drawn in from each end and hot air is forced out each side.

"The radiators, engine turbo aftercoolers for both large engines, screw compressor oil and screw compressor aftercooler were supplied by L&M Radiator," said Gruner. "The radiators are designed to allow field repairs so you don't have to remove the radiator entirely. The ASME code high-pressure sections for the booster were provided by Fin-X."

A 760 hp at 2000 rpm Cummins QSK-19 engine drives the Quincy QSG-1750 screw compressor. "We have the engine driving a speed increaser, which then drives the screw," said Gruner. "That actually drives the screw a little bit faster, which allows us to reach 2100 to 2200 cfm [59 to 62 m^3/min], which is pretty impressive for a single-screw compressor. Right now the highest-flow single screw on the market is probably in the 1500 to 1600 cfm [42 to 45 m^3/min] range. We're at 2100, and with the Quincy's larger size we are still not turning the screw that fast compared to other products on the market, which almost always incorporate a much higher ratio gear increaser on the front of the screw anyway.

"One of the reasons we use the Quincy screw compressor is that it has a mechanical seal in it so you can use it for gas or air. It also has large 321 mm rotors, rotor-driven oil pump, and larger shaft and bearings than other compressors in this market."

According to Gruner, the screw compressor is rated up to 210 psi (14.5 bar), but runs 160 to 190 psi (11 to 13 bar) for this application. "This screw has bigger bearings and a high oil flow rate to handle the differential pressure. It has a four-step capacity control system. If there is a job which does not require full flow, you not only have rpm to control it, you also have capacity control."

The operator can choose to run the air out to a dryer or nitrogen unit and then come back to the booster, or come straight from the screw to the booster. Also, if the air is needed to go to a nitrogen unit, it can be piped there (with flow from added screws if needed to make up the lost flow) and the entire flow can return to the booster for final compression.

The three-stage Superior CFA-34 booster compressor is driven by a Cummins QSX-15 engine rated 600 hp (447 kW) at 1800 rpm. "We chose Superior because we felt the directly opposed (as opposed to offset opposed) design would run more smoothly on the trailer, and we have found that this unit runs very smoothly at a wide range of rpms and pressures. We worked very hard to design a stiff engine/compressor chassis supported by vibration-absorbing material, with a tolerant coupling to prevent slight misalignment from damaging the compressor.

"Other trailer-mounted recips on the market often suffer from misalignment problems caused by stiff couplings in combination with changing alignment due to the flexing of the trailer on uneven ground. The engine and the compressor are on their own single pedestal, which keeps everything in-line. The base incorporates a rubber isolation mounting system to absorb high-frequency vibration and some low-frequency vibration. The booster is rated 2550 psi [176 bar], but we are running between 2100 and 2300 psi [145 to 159 bar]," said Gruner.

The National Oilwell 80T-3M triplex plunger pump is driven by a Cummins QSB 3.3 engine rated 80 hp (60 kW) at 1750 rpm. "We utilize a four-speed transmission which provides a lot of flow range," said Gruner. "Driven by a driveline, we use a 3.5 to 1 gear reduction box. The pump is rated to 42 gpm [159 L/min] at 2500 psi [172 bar] and its system incorporates two tanks, with recirculation, and foam/chemical injection. An operator can draw from one tank and mix in polymers, etc., used for drilling in the other to allow continuous operation."

The entire unit was fabricated by Compression Leasing Services. "What's unique about our company is that we are ASME code certified," said Gruner. "Every bottle, every vessel on this entire unit is built in-house to ensure our quality standards are met. We seal-weld the skids for environmental protection. We x-ray and hydro-test each weld on the unit as needed to meet ASME B31.3 requirements. That standard allows us to compress air or natural gas in a spec that is high above our competition."

Maintenance schedules are standard for the engines and the compressor. Accessibility was a priority during the design of the unit. "We made all of the service points easy to access. All of the ball valves, for example, are on the edge of the trailer, along with the drain points, so you don't have to physically climb up onto the unit to do standard maintenance. Everything is low-point drained so the oil comes out of the unit very easily."

There is a centralized operating panel located on the side of the trailer. Control readouts include power load, fuel consumption, pressure and temperature. "We use Cummins-supplied engine monitors," said Gruner. "You can start any engine independently, run any unit independently, but they are designed to all be run together. Every function is on the panel. But we also have independent gauges around the entire unit. If an operator is not

The vertical ductwork radiator plenum on the Cummins QSB 3.3. This engine drives the National 80T plunger pump. It is used to divert the hot air upward and has louvers that close when the engine is not in use.

gal. (2082 L), double-walled, DOT-approved tank that allows full fuel transport. "Most trailer units only utilize a single-walled non-DOT tank which requires them to travel empty and be filled on-site," said Gruner. "Ours can arrive on location, fueled and ready to go. In addition, fuel coolers are built into each engine system preventing the high return fuel temp of most engines from overheating the fuel in the tank. This unit should be able to complete an eight-hour shift on one tank of fuel."

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sure about a reading, he has a cross check to help verify the reading.

LED lights on the panel and lights mounted all around the unit allow night operation.

According to Gruner, each engine incorporates a spark-arresting exhaust muffler, meeting the compliance requirements needed to operate in a variety of locations.

Emissions standards are met via Tier 3 engine ratings, with the exception of the QSK, which is Tier 2 since there is not a Tier 3 grouping for engines of that power. Engines of that power will skip from Tier 2 to Tier 4 in the future.

The trailer is equipped with a 550

The booster compressor's engine radiator and charge-air cooler and compressor intercooler and aftecooler sections. CLS designed the cooler arrangement and built the plenum. The engine radiator and charge-air cooler were built by L&M radiator, and the compressor intercooler and aftercooler sections were built by Fin-X.