Hydraulic Fracturing: Gas turbine proves successful in shale gas field operations

Gas turbine drives a 4500 hhp pump to provide high flow and pressure in hydraulic fracturing application

CHALLENGE

Provide sufficient power on a single trailer to drive a 4500 hhp pump using wellhead gas

SOLUTION

Install a Vericor TF50F gas turbine, with dual fuel capability, to a reciprocating pump on a truck

RESULTS

Reduced fleet size and footprint with highly reliable turbine power

High torque output at low rpm with real-time torque monitoring

Dual fuel switching while under load

OVERVIEW

In May 2015, a new design for a turbine fracturing pumper, the Apollo 1, made successful tests in the shale gas well zipper fracturing operation by CNPC in Weiyuan County, Chinese Sichuan province in China. Under a wellhead pressure of up to 75MPa, the unit delivered a steady performance at 2.2m³/min displacement, which is nearlt equivalent to the output displacement of two conventional 2500hhp drivetrains.

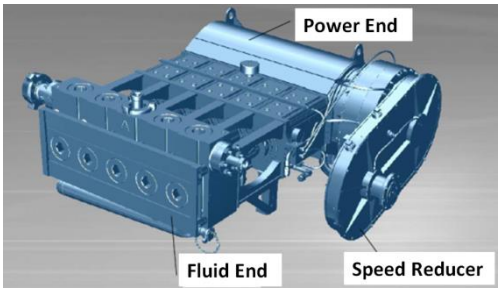
By June 2015, Apollo 1made its appearance in the operation of CNPC Zhejiang oilfield in Chinese Sichuan Province where three layers were fractured each day. Each job takes 3.5 hours and 15 layers in total. The following month, the unit joined the operation by SWMS, a J.V company of CNPC and Shell, in Longhui county, Weiyuan city, Sichuan province and succeeded in fracturing 23 layers.

The Apollo 1's high power of 4500hhp pump is highly applicable to high pressure well conditions and challenging operations that demand significant displacement volumes at reduced operating costs. The presence of several conventional units will make the whole job more flexible and efficient.

As the output flow rate of a single turbine fracturing pumper equals those of two conventional 2300hhp combined, the footprint of fleet, pipe connecting workload and crew members are nearly halved compared to conventional operations.

The 4500 hhp Apollo1 Hydraulic Fracturing Trailer in Field Tests

Sichuan Province, China

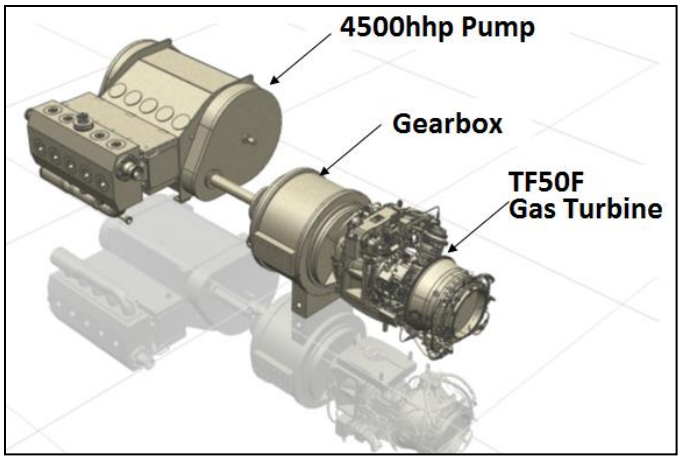


Hydraulic Pump Parameters

- Rated Brake Horsepower: 4,500HP 3,356KW)
- Maximum Rod Load: 251,327lbf (1,118KN)
- Stroke Length: 11" (279.4mm)
- Gear Ratio: 5.642:1
- Weight: 23,148lbs (10,500kg)

Case Study details and the benefit of an aeroderivative gas turbine

To date Apollo 1 has run smoothly for over 200 hours in local oilfield operation. Its favorable road adaptability proved well suited to handle the rugged mountainous area of Sichuan province. In April 2015, Jereh performed an hydraulic horsepower test on the unit fueled by diesel and natural gas at Jereh facilities. The switching of fuels under load turned out to be a big success. Currently, gas conditioning equipment is being developed for field operations. Once complete, natural gas direct from the well head can be used as the primary fuel, cutting diesel fuel costs significantly. A major plus of natural gas is that it is considered to be more environmental-friendly due to its low emissions after burning. The turbine fracturing pumper is opening up a new era in the course of industrial evolution.



Apollo 1 Drive Train

Vericor's TF50F Gas Turbine

Jereh selected Vericor Power Systems TF50F™ gas turbine due to its proven aero-derivative design that is specifically configured for mechanical drive use.

Advantages of using these gas turbine systems for mechanical drive applications are many:

- Compact size allows for easy on site installation and change out
- High operational readiness
- Fast cold start characteristics
- Low emissions and vibration
- Flexibility to efficiently burn a variety of fuels
- High reliability and low maintenance requirements

The modular nature of these engines allows for easy inspections on site. This ease of care approach simplifies stocking of spares and lowers downtime and maintenance periods. Recommended maintenance cycles for each ASE gas turbine are 30,000 hours for a hot section overhaul and 60,000 hours for a major overhaul.

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