Finley Resources, Inc. – Pumpjack Engine Emission Measurement Inspections – Uinta Basin, Utah Wellpads – On-Site Partial Compliance Evaluations (PCE)

Inspection Dates:	9/15/21, 9/29/21
Inspection Report Date:	11/15/2021
Inspection Report Prepared By:	Cindy Beeler
Inspection Report Reviewed By:	Scott Patefield, Branch Chief SCOTT PATEFIELD Digitally signed by SCOTT PATEFIELD Date: 2021.11.15 09:27:40 -07'00'
EPA Inspectors:	Cindy Beeler (9/15/21) Tracey Footer, ERG (9/29/21)
Company Representatives:	Jason Lachance, Senior Facilities Engineer (9/15/21 and last site on 9/29/21) Brent Cook, Lead Mechanic (9/15/21) Rafael Vargas, R&R Oilfield Services (9/15/21) Nate Adamson, LDAR Technician (9/29/21)
Tribal Representatives:	Mike Natchees, Director, Air Quality Program, Ute Indian Tribe (UITAQ) (9/15/21) Marie Kaufusi, UITAQ (9/15/21) Monaco Weidner, UITAQ (9/15/21)
State Representatives:	None
Parent Company Address:	PO Box 2200 Fort Worth, Texas 76113
Facilities County/State Location:	Uintah/Utah
EPA Region:	Region 8
Specific Facility Information:	See Table 1

Inspection Information

As part of a regional effort to better characterize emissions from pumpjack engines, United States Environmental Protection Agency (EPA) and Ute Tribal Air Program inspectors visited several Finley Resources wellpads in the Uinta Basin in Utah. The objective of the testing is to verify point source pollutant levels used for air quality modeling and emission inventories, assess the effectiveness of engine emission regulatory limits, and evaluate the emissions maintenance practices of individual operations. The engine emission tests were conducted by a third-party contractor, Alliance Source Testing (AST).

In the aggregate over three weeks, the EPA and its contractor conducted testing at 61 engines with seven operators. The sample population was created to reflect the universe of almost 3,400 pumping spark-ignition engines as provided in the 2017 Uinta Basin Emission Inventory – by operator, by engine make and model, by age of engine, and by jurisdiction. The aggregate results are shown below:

# Engines Tested:	61			
	AST g/hp-hr (11/1/21)			
	CO	NOx	CH4	NMHC
Average:	92.9	1.8	1.5	34.0
Median:	72.5	0.29	0.0013	30.4

Table 1 lists the Finley sites inspected, their location, the dates of inspection and the start time of each test run. Note that 'facility names' with the same latitude and longitude reflect the well name and its associated pumpjack engine at a multi-well wellpad facility. For example, the facility name of the first four engines listed in Table 1 was "Fin Federal 4-5a-8-20, Fin Federal 4-5b-8-20, Fin Federal 4-6a-8-20, Fin Federal 4-6b-8-20."

Table 1 – Sites Inspected

facility_name	facility_latitude	facility_longitude	facility_county	Date_insp	Run_start Time
Fin Federal 4-6b-8-20	40.15598	-109.6774	Uintah	9/15/2021	8:24
Fin Federal 4-6a-8-20	40.15598	-109.6774	Uintah	9/15/2021	9:02
Fin Federal 4-5a-8-20	40.15598	-109.6774	Uintah	9/15/2021	9:37
Fin Federal 4-5b-8-20	40.15598	-109.6774	Uintah	9/15/2021	10:19
Fin Federal 33-6b-7-20	40.168785	-109.67633	Uintah	9/15/2021	11:15
Fin Federal 33-6a-7-20	40.168785	-109.67633	Uintah	9/15/2021	11:51
Pelican 88 22-4a-7-20	40.20134	-109.66319	Uintah	9/15/2021	13:39
Three Rivers 32-41-720	40.17222	-109.68446	Uintah	9/15/2021	15:10
UTE 13-8A-4-1	40.13796	-109.82336	Uintah	9/29/2021	8:56
UTE 13-1 C	40.1414	-109.82258	Uintah	9/29/2021	9:43
UTE 13-16A-4-1	40.12967	-109.82336	Uintah	9/29/2021	10:49
UTE 13-15A-4-1	40.12965	-109.82738	Uintah	9/29/2021	11:43
UTE 13-11A-4-1	40.13423	-109.83217	Uintah	9/29/2021	13:36
UTE 13-12A-4-1	40.13443	-109.83876	Uintah	9/29/2021	14:30

The inspection team adhered to the following approach for the engine measurements:

1) At the beginning of each day, EPA met Finley, AST, and other agency personnel offsite and shared a list of geographically clustered Finley wellpads with engines.
   a) On 9/15/21, EPA inspectors Cindy Beeler, Sara Loiacono and Cindy Schafer met at Hwy 191 & 88 (16500E) and the Ute Tribe Air Program personnel accompanied the inspections. Sara Loiacono and Cindy Schafer did concurrent tanks inspections at the engine sites and other sites (a separate inspection report from Sara Loiacono covers those inspections). From Finley, Jason Lachance accompanied us throughout the day as did Brent Cook. Rafael Vargas, a Finley engine services contractor, was also present.
   b) On 9/29/21, EPA representative, Tracey Footer of Eastern Research Group (ERG), met at the corner of HWY 191 & 7500E (Ar88 Fort Duchesne). From Finley, Nate Adamson accompanied Tracey Footer throughout the day. Two site operators showed up at separate times (their names were not noted). Jason Lachance was present at the last site.

   With input from Finley, we proceeded to a subset of sites on the list where engines were gas-powered and operating, testing as many engines as possible in the day.

2) AST positioned their testing trailer to be a safe distance from the process equipment.

3) AST began set up and conducted the calibration of the analyzers at the first site each day. The analyzers were kept running between sites with (1) a generator in the bed of the truck; and (2) power conditioned/battery back-up - so they could hold a calibration for the remainder of the day. Following the calibration, and at succeeding sites, AST ran the pre-bias check, a 21-minute

measurement with pollutants recorded each minute, and the post-bias check.

4) EPA photographed the site sign.

5) EPA asked questions to describe the operating parameters of the engine, the associated equipment around each engine, and the maintenance schedules as well as taking numerous photographs. Table 3 summarizes the information collected.

Testing Information

Testing was conducted to determine the emission rates of nitrogen oxides (NOx), carbon monoxide (CO) and non-methane hydrocarbons (NMHC) from the engine exhausts.

Emission rates were calculated using the Wyoming Analyzer Protocol, Page 25, Section 10.1.2. Where manufacturer-specified Brake Specific Fuel Consumption (BSFC) in BTU/HP-hr and nameplate horsepower were available, those were used in calculations for emission mass rates. For site-rated hp, nameplate was adjusted to 5,000 elevation. Where they were not available, the Wyoming Analyzer Protocol default value of 9,400 BTU/hp-hr was used. Where manufacture year or horsepower were not available on the engine nameplate, or there was no nameplate, the year and horsepower noted were identified by the EPA relying on emission inventory data submitted by Finley.

The emission testing program was conducted in accordance with the test methods listed in Table 2. Method descriptions are provided in Attachment A - AST Test Report.

Table 2 - Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Oxygen / Carbon Dioxide	3A	Instrumental Analysis
Nitrogen Oxides	7E	Instrumental Analysis
Carbon Monoxide	10	Instrumental Analysis
Volumetric Flow Rate	19	Fuel Factors / Heat Inputs
Non-Methane Hydrocarbons	25A	Instrumental Analysis
Gas Dilution System Certification	205	--

Other Field Notes

Maintenance practices - Brent Cook described yearly oil, oil filter, grease and air filter changes and that Finley maintains a “service record.” Jason Lachance described that oil and filters should be changed quarterly. Finley does not currently have a well-defined maintenance plan in place, but one is under development.

The inspector could not observe the pressure of the fuel gas entering the engine because many sites did not have pressure gauges, or gauges in place were not operating.

Some engines had a “tattle-tale” which the inspector understood to be a shutdown system if the engine goes down directing the fuel valve to close, so the engine does not bleed gas until the engine is restarted. The “tattle-tale” also aids the operator when they arrive on-site to troubleshoot why the engine shut down (e.g., a wellhead kick, too much vibration, temperature too high).

At wellpads inspected on 9/15/21, dry, processed gas came from Lake Pelican Compressor Station (CS). The source compressor station for dry fuel gas at wellpads inspected on 9/29/21 was not noted.

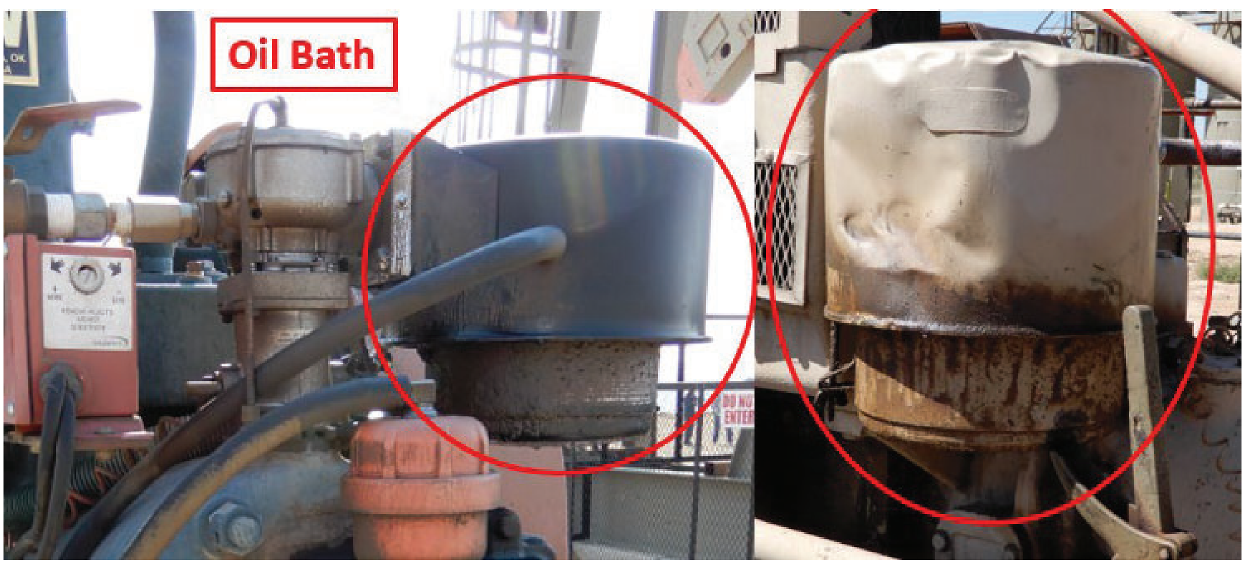
The engines run continuously, even if the pumpjack is not pumping, when this can be referred to as "clutched" or idled" while the engine continues to run to power a heat trace circulation pump that provides a heated medium throughout the wellpad (tank heaters, heater treater, heat trace along piping, etc.).

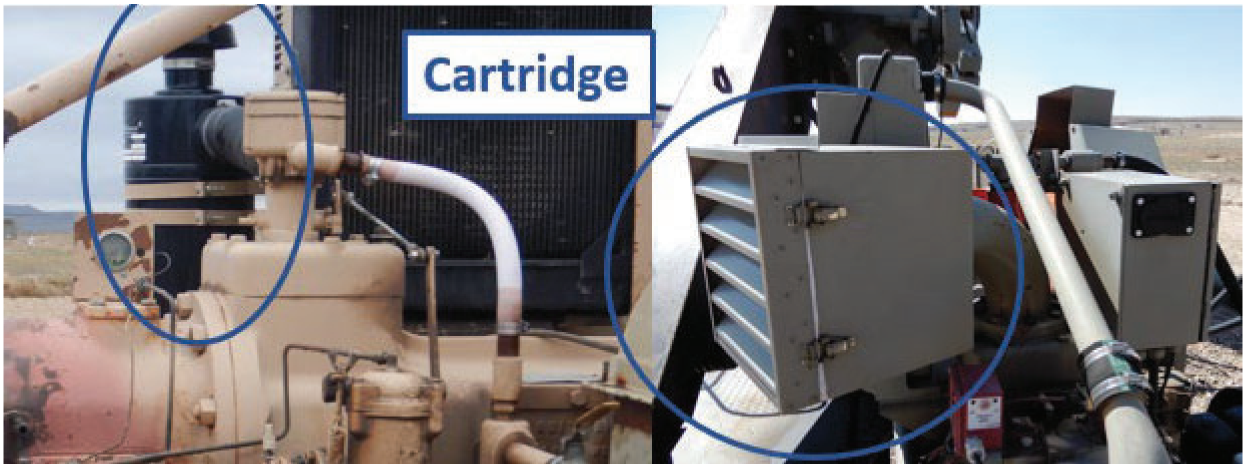
Seeking Finley Review and Input

The EPA would like to better understand what could influence pumpjack engine emissions and so seeks Finley's review and input on the equipment associated with each engine. From observations and conversations with operators, engine manufacturers, and experienced engine stack testers, EPA offers descriptions and photos of our understanding of nomenclature around equipment associated with the engine. In addition to the following questions, the EPA requests Finley's confirmation of the engine parameters and configurations listed for each engine in Table 3, below.

1) Confirm the engine Make/Model, nameplate HP, serial #, and engine category (e.g., 2-Stroke Lean Burn [2SLB], 4SRB).

2) Confirm the manufacture year of each engine with particular attention to whether, and when, the engine may have been reconstructed, remanufactured, reconditioned, rebuilt, refurbished, or modified.





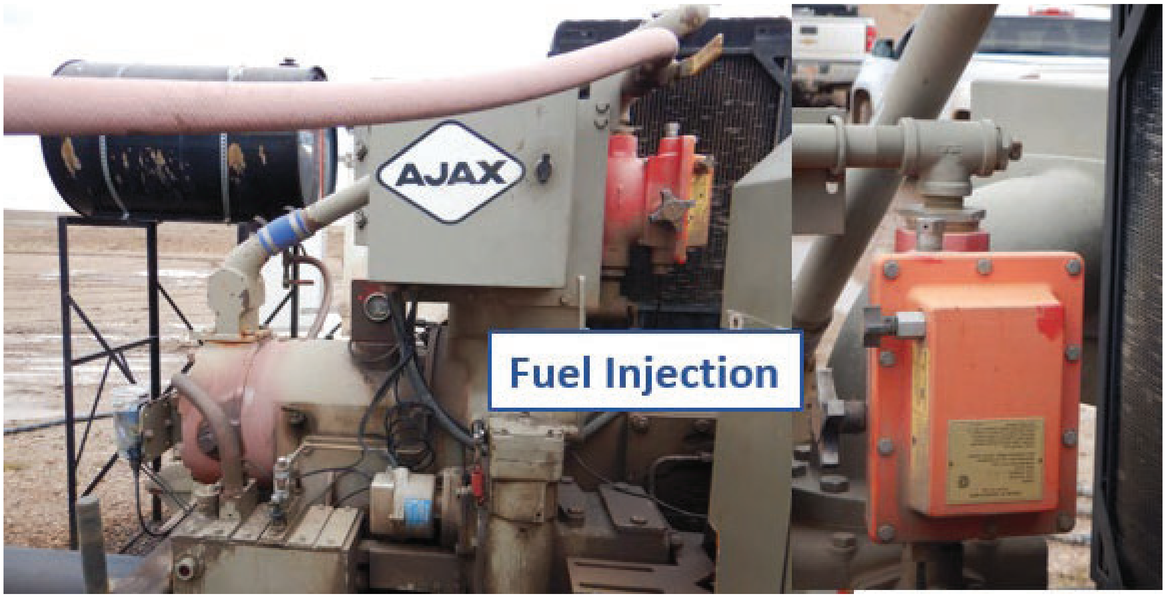
4) Knock-Out (KO) Scrubbers – Inspectors noted whether there was a single KO scrubber on the fuel gas entering the engine, or sequential dual KO scrubbers.

5) Fuel Gas Source – Casing free gas (gas from the annulus on the backside of the production tubing, direct from the well casing), separator gas (the associated gas with oil production that comes off the wellpad's separator or heater treater), or dry processed gas (piped in from a neighboring compressor station). Noted during inspection was EPA's understanding of the fuel gas source used by the engine during testing determined by walking the lines with the operator. On 9/29/21, we received conflicting responses and observations from walking the piping that routed the fuel gas to the engines. EPA understands that the fuel gas source can be changed at each site. For example, if dry processed gas is distributed to wellpads from a compressor station and the pipeline should freeze, or the compressor station is down, the wellpad could switch to either casing free gas or gas from the separator on-site.

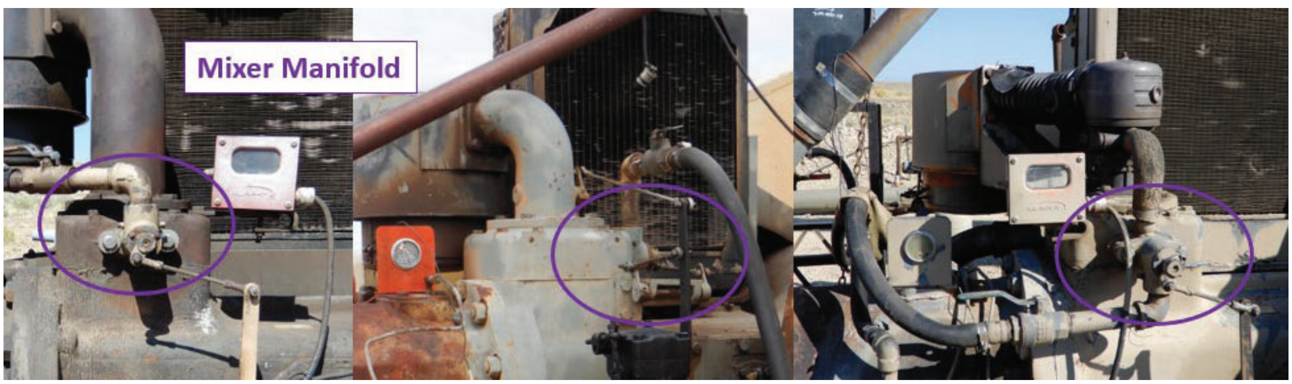
   What records does Finley keep regarding the source of fuel gas being used on-site?

6) Air Fuel Control – carburetor, fuel injection, mixer manifold, or Air Fuel Ratio Control (AFRC). From conversations with operators, engine manufacturers and experienced engine stack testers, EPA's understanding of various air fuel control systems present in the field are described with photos as the examples shown below:

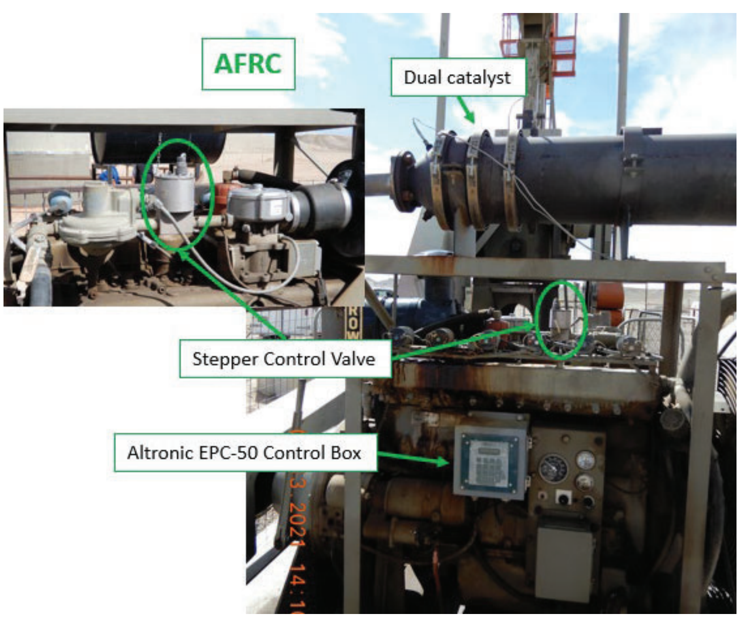
   The fuel gas is routed to the carburetor where the air intake is also routed. The governor controls the engine speed and is linked to the carburetor.



The "AJAX" control box + the red Murphy fuel control valve to the right of the AJAX box = fuel injection system.

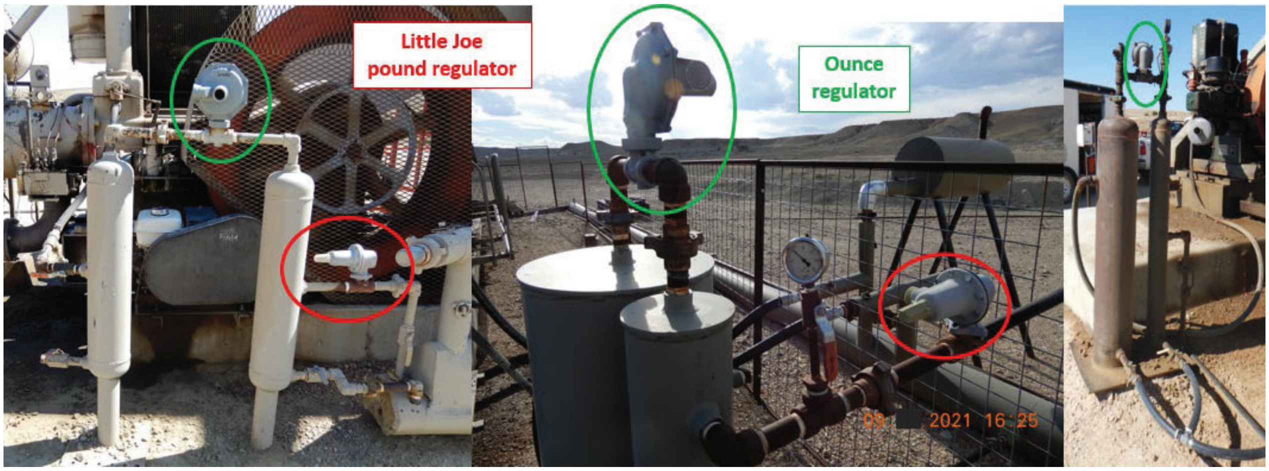


The fuel gas is routed to the mixer manifold where the air intake is also routed. The governor controls the engine speed and is linked to the mixer manifold.

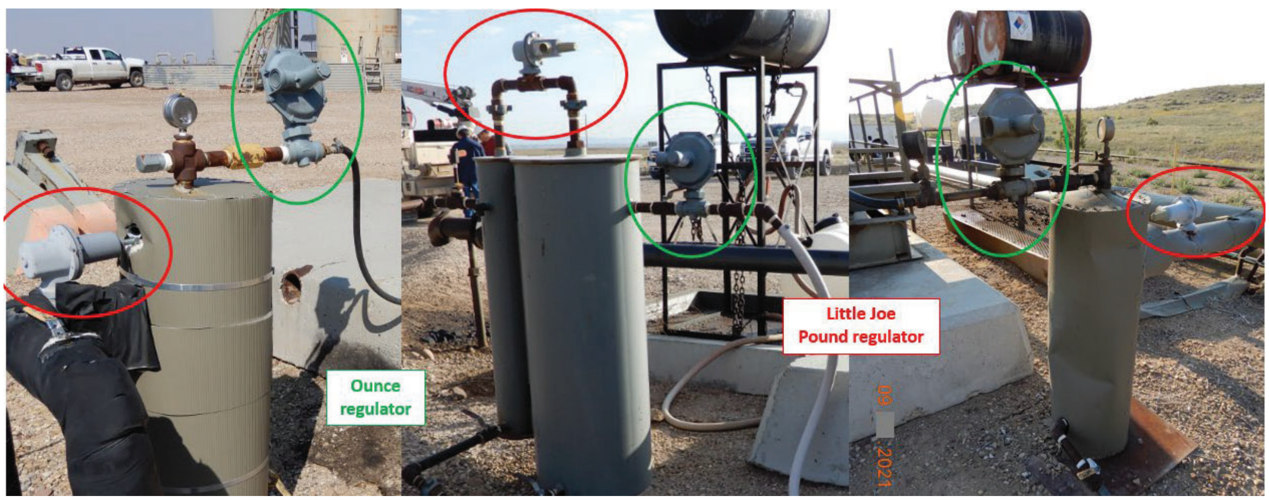


Dual catalyst chamber on the engine exhaust. The Stepper control valve is to the right of carburetor (visible in the background) and shown zoomed in from another perspective. On the bottom is an Altronic EPC-50 control panel (CD1 digital ignition, electronic governor, O2 sensors, voltage signal to Stepper valve to control fuel flow, cam/crank sensors). EPA's understanding is the combination of this equipment is an Air Fuel Ratio Control (AFRC) system.

7) Fuel Gas Volume Capacity – Yes or No. A gas volume tank provides a reservoir of pressurized fuel gas to meet engine demand. Without a gas volume vessel, the available reservoir capacity is in the piping conveying the fuel gas to the engine.



If the Ounce regulator is BEFORE the last KO scrubber and the engine, then fuel gas volume capacity IS available to the engine, equal to the volume of the 2nd KO scrubber (Y). The pressure of the fuel gas is adjusted by springs within the regulator - if spring is all the way out → discharge pressure is the minimum pressure of range of the regulator. If spring is all the way in → discharge pressure is the maximum pressure of range of the regulator.



If the Ounce regulator is between the KO scrubber and the engine, then there is NO fuel gas volume capacity available for the engine (N), besides within the fuel gas line running to the engine. The pressure of the fuel gas is adjusted by springs within the regulator - if spring is all the way out → discharge pressure is the minimum pressure of range of the regulator. If spring is all the way in → discharge pressure is the maximum pressure of range of the regulator.

8) EPA requests the most recent fuel gas analyses available for each fuel gas source available for use on each site – casing gas, separator gas and dry processed gas.

9) Maintenance Practices – EPA requests a summary of the manufacturer recommended maintenance and servicing for each engine make/model listed in Table 3 and a table showing the maintenance performed by Finley on each engine from 1/1/2019 to now.

Table 3 – Provides parameters describing each engine tested, the emission rate results from AST, the manufacturer-provided brake-specific fuel consumption (BSFC), and characteristics of the equipment associated with the engine and fuel gas source observed during testing.

make	model	manufacturer_year	horsepower	engine_category	Serial #	facility_name	AST_CO_g_hphr	AST_NOx_g_hphr	AST_CH4_g_hphr	AST_NMHC_g_hphr	AST_02_%dry	BSFC_BTU/hphr	air_filter_type	KO_Scrubbers	fuel-source	air_fuel_control	fuel_gas_volume_capacit
Ajax	E-565	2014	40	2SLB	86724	Fin Federal 4-6b-8-20	3.0	0.21	0.000	43.2	13.81	13300	Cartridge	Dual	Separator gas	fuel injection	Y
Ajax	E-565	2014	40	2SLB	86693	Fin Federal 4-6a-8-20	5.1	0.054	0.000	74.7	16.52	13300	Cartridge	Dual	Separator gas	fuel injection	Y
Ajax	E-565	2015	40	2SLB	86730	Fin Federal 4-5a-8-20	4.1	0.081	0.000	99.2	15.60	13300	Cartridge	Dual	Separator gas	fuel injection	Y
Ajax	E-565	2014	40	2SLB	86727	Fin Federal 4-5b-8-20	5.0	0.15	0.000	69.2	14.77	13300	Cartridge	Dual	Separator gas	fuel injection	Y
Ajax	E-565	2014	40	2SLB	86679	Fin Federal 33-6b-7-20	3.8	0.089	0.000	81.3	15.38	13300	Cartridge	Dual	Casing gas	fuel injection	Y
Ajax	E-565	2014	40	2SLB	86702	Fin Federal 33-6a-7-20	8.5	0.030	0.000	102.9	16.22	13300	Cartridge	Dual	Casing gas	fuel injection	Y
Ajax	E-42	2014	40	2SLB	66772	Pelican 88 22-4a-7-20	174.1	0.11	0.000	24.2	6.60	13300	Oil bath	Dual	Casing gas	carburetor	Y
Arrow	L-795	2012	65	2SLB	L-601186	Three Rivers 32-41-720	56.4	0.48	0.000	35.6	11.09	12081	Oil bath	Dual	Casing gas	carburetor	Y
Ajax	E-42	1958	42	2SLB	58296	UTE 13-8A-4-1	150.3	0.18	2.1	46.3	8.77	13300	Cartridge	Dual	Processed gas	carburetor	N
Ajax	E-42	1951	42	2SLB	51036	UTE 13-1 C	220.4	0.060	3.1	30.4	12.83	13300	Oil bath	Single	Processed gas	carburetor	N
Ajax	E-42	1964	42	2SLB	64617	UTE 13-16A-4-1	4.2	0.89	1.7	8.5	4.81	13300	Cartridge	Dual	Casing gas	carburetor	N
Ajax	E-42	2012	42	2SLB	86154	UTE 13-15A-4-1	1.0	14.1	2.8	54.1	11.76	13300	Cartridge	Single	Processed gas	fuel injection	N
Ajax	E-42	1969	42	2SLB	69049	UTE 13-11A-4-1	143.1	0.20	1.7	19.0	5.47	13300	Oil bath	Dual	Casing gas	carburetor	N
Ajax	E-42	2012	42	2SLB	86112	UTE 13-12A-4-1	1.5	1.1	3.0	43.6	12.48	13300	Cartridge	Single	Casing gas	fuel injection	N

Areas of Concern

Test data has identified certain engine emissions in exceedance of the limitations found in the New Source Performance Standards, Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines:

> §60.4233(d) Owners and operators of stationary SI ICE with a maximum engine power greater than 19 KW [25 HP] and less than 75 KW [100 HP] . . . must comply with the emission standards for field testing in 40 CFR 1048.101(c)
>
> §1048.101(c) Standards for field testing. Starting in 2007, exhaust emissions may not exceed field-testing standards, as follows:
> (2) The HC + NOX standard is 3.8 g/kW-hr [2.83 g/hp-hr] . . . For natural gas-fueled engines, you are not required to measure nonmethane hydrocarbon emissions or total hydrocarbon emissions for testing to show that the engine meets the emission standards of this paragraph (c); that is, you may assume HC emissions are equal to zero
>
> §1048.101(c)(2) . . . and the CO standard is 6.5 g/kW-hr [4.85 g/hp-hr].
>
> §60.4230(a)(4)(iii) . . . the requirements of subpart JJJJ apply to engines manufactured on or after July 1, 2008, if they are <500 HP.

Attachment A - AST Test Report

File: 21-2251-002 ERG Finley Resources PJ Engine Testing_DraftR1.pdf