

CLEANBURN PLUS™ AJAX® 2800 INTEGRAL ENGINE

An Emerging Legends™ Series Product

Cooper Delivers Environmentally Friendly AJAX Integral Engines & Retrofits

Cooper has redesigned AJAX® 2800 series engine components and combustion geometry to deliver a significant reduction in NOx emissions using lean combustion and without selective catalytic reduction (SCR) while achieving compliance with hydrocarbon (THC) emissions regulations. The new and improved AJAX® CleanBurn Plus™ 2800 integral engine-compressor now operates at or below 0.5 g/bhp-hr NOx levels and with additional reductions in hydrocarbons and fuel consumption. Retrofits are available for AJAX engines.

Technical enhancements include:

- › High compression ratio piston
- › Optimized power cylinder head
- › Center-mounted pre-combustion chamber
- › Electronically controlled fuel injection system
- › Optional intake bypass system reduces hydrocarbon emissions at off-load conditions

Key Benefits	Standard	CleanBurn Plus™	Improvement
Power (bhp)	192-800	192-800	—
NOx (g/bhp-hr)	12	0.5	96%
CO (g/bhp-hr)	1.3	1	23%
VOC (g/bhp-hr)	0.7	0.7	—
BSFC (Btu/bhp-hr)	8,200	7,400	10%

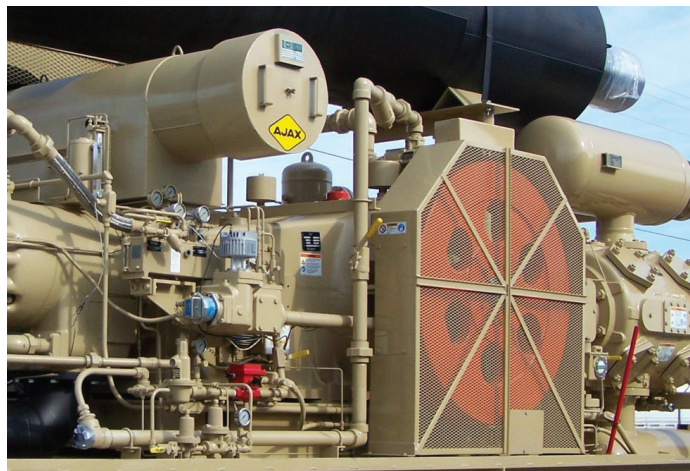
Note: Site conditions may affect the actual power output and fuel consumption.

High Compression Ratio Piston

Low NOx and hydrocarbon emissions reductions are achieved without aftertreatment. The high compression ratio piston improves fuel efficiency and enables the engine to operate at ultra lean air/fuel ratios.

LEGENDS DON'T STOP. WE MAKE SURE OF IT.™

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AJAX® 2802 Engine-Compressor

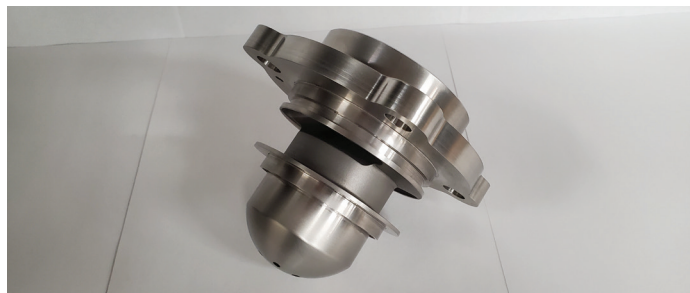
The design of this piston maintains AJAX's legendary ability to tolerate hot fuels and high H₂S levels.

Optimized Power Cylinder Head

Our power cylinder head retains the ruggedness of the existing AJAX® 2800 series, while delivering even better performance. Our geometric changes to the head allow for an electronically controlled, hydraulically actuated fuel system with center-mounted pre-combustion chamber. The head is now optimized to run more efficiently with substantially lower emissions.

Center-Mounted Pre-Combustion Chamber

Optimum performance requires a pre-combustion chamber (PCC) design that ignites the main chamber efficiently and reliably. By mounting the PCC at the center of the cylinder head, the air/fuel mixture is ignited evenly throughout the combustion chamber. This concept is already proven in the Cooper-Bessemer engine lines and is further optimized for the AJAX® line. This proven technology gives AJAX® a true 0.5 g/bhp-h NOx and hydrocarbon reduction solution, while maintaining the durability of the 2800 series.



AJAX® Center-Mounted Pre-combustion Chamber



AJAX® Frame Ratings	DPC-2801	DPC-2802	DPC-2803	DPC-2804
Power (bhp/kW)	192/143	384/286	600/447	800/597
BSFC (Btu/bhp-hr)	7,400	7,400	7,300	7,300
NOx (g/bhp-hr)	0.5	0.5	0.5	0.5
Max/Min Speed (RPM)	440/300	440/300	440/300	440/300
No. of Power Cylinders	1	2	3	4
No. of Compression Cylinders	1	2	2	3

Note: The above performance is at sea level using pipeline-quality natural gas. Site conditions may affect the actual power output and fuel consumption.

Electronically Controlled Fuel Injection System

The electronically controlled fuel system uses hydraulic power to individually actuate the fuel valves. Each cylinder will run at an optimized air/fuel ratio. The valves create ideal mixing of the air and fuel in the main combustion chamber, enhancing combustion stability, and reducing emissions. The system provides the benefit of high-pressure fuel injection while keeping the supply pressure unchanged from the standard 2800 series.

Intake Bypass System to Reduce Hydrocarbon Emissions

As methane emissions face greater scrutiny, Cooper is again taking the lead by designing AJAX® engines to minimize their footprint. In two-stroke engines like the AJAX® 2800 series, the air/fuel ratio can become too lean when targeting reductions in NOx levels at lower load requirements.

A leaner air/fuel ratio results in incomplete combustion and high methane output when the engine's load is reduced. Our patented approach to correcting high methane output at low engine torque is to bypass a controlled amount of intake air. This re-optimizes the air/fuel ratio such that the engine runs at proper conditions across the operating map, reducing hydrocarbon emissions. Exhaust temperatures are kept high at off-load conditions, further optimizing the operation of the oxidation catalyst.

Cooper First to Burn Hydrogen Fuel in an Integral Engine, Reduces THC Emissions

In Q1'22, Cooper successfully tested a slow-speed integral engine running on a hydrogen (H2)-natural gas fuel blend. The groundbreaking test came just 5 months after the announcement of Cooper's joint hydrogen research project with a major U.S. gas pipeline company to demonstrate the safe operating range of H2 blends in large-bore internal combustion engines. The test used an H2 blend of 5% by volume, and we achieved significant reductions of hydrocarbons in the exhaust. This is the first such run using significant amounts of hydrogen in an engine of this design.

The test was conducted at our slow-speed integral engine test cell at corporate headquarters located in Houston, Texas. The test engine is the current production, NSPS compliant CleanBurn Plus™ AJAX 2802 with 15" piston bore, 16" power stroke, and a speed range of 360-440 RPM.



Emerging Legends™ Series

Cooper's CleanBurn Plus™ AJAX® 2800 engine-compressor is a member of the Emerging Legends™ Series, our portfolio of new products and services that advance the industry and transform Cooper's traditional way of doing business. Emerging Legends™ serves as a testament to the Cooper commitment of optimizing performance of legacy engines and compressors, helping our customers extend the life of their equipment, and bringing environmentally sustainable solutions to the market.

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