



MORBARK®

TAKING **ALTERNATIVELY POWERED EQUIPMENT** TO

The Next Level



Is An Alternatively Fueled Engine Right For You?

Between the tightening of regulations, instability of traditional-fuel prices, and discovery of new fuel extraction technologies, alternatively fueled engines for off-road equipment is an increasingly attractive option. Natural gas, propane, electricity, and biofuels offer cleaner, domestically produced energy at a lower overall cost; and the latest green technologies allow engines to use less fuel.

Morbark® now offers alternative-fuel engine options for our line of Tree Care Products, including all Beaver™ Brush Chippers and stump grinders. Offering these alternatives afford our customers maximum protection against volatile fuel markets and allow them to transition gradually into a new fuel strategy. And with alternative fuel stations becoming more and more numerous, alternatively fueled engines can be practical as well.

CNG: Giving Diesel a Run for the Money

At about half the pump price of diesel, Compressed Natural Gas (CNG) has become a serious contender in sectors traditionally running diesel engines. Tier IV emission regulations will require diesel users to purchase Tier IV final engines with after-treatments, with compliance-related expenses projected to rise to more than 60% over Tier 3. And Tier IV-compliant diesel systems are heavier and bulkier, some having a 70%+ larger footprint.

The natural gas alternatives are compact, light and service-friendly in the event field repairs are needed. Plus, the stability of the natural gas fuel market makes converting fleets to CNG a smart investment. Our fuel-flexible engine solutions are compatible with natural gas, propane, gasoline, and bio-fuels.

Alternative-fueled engines are compatible with natural gas, propane, gasoline, and bio-fuels.



Propane: More than 60 Years of Clean Power

Also known as liquid propane (LP) and liquefied petroleum gas (LPG), propane is a domestically produced, clean-burning fuel that's been widely used in engines since the early 1950s. Its domestic production provides price stability, and its renewable, non-toxic nature make propane a fuel you can feel good about.

In addition to preserving the planet, propane's favorable environmental profile means that, even in an emissions-focused future, it is less likely to incur the heavy regulation seen with dirtier fuels like diesel. Lower maintenance costs are an added benefit to using propane. Propane's high octane and low carbon and oil contamination extend engine life compared to conventional engines. And because it can be converted to gas before it's combusted, propane may reduce the cold-start problems associated with traditional liquid fuels.

PTO: Power Take-Off Option

Some chip trucks are now offered with Power Take-off (PTO) capability, meaning they have an output shaft located at the rear for powering auxiliary equipment. Morbark has developed a tow-behind PTO-driven chipper that eliminates the need for a dedicated engine on the chipper, while still offering features chipping crews have come to expect, such as automatic feed systems, ChipSafe™ operator safety shield, and the ability to engage and disengage the chipping drum. This can be especially advantageous for crews moving frequently up and down city streets. Components required to make diesel engines Tier-IV-compliant are adversely affected by extended engine idle time, and allowing chipper engines to idle between multiple curbside stops could increase the frequency of costly component maintenance or replacement. Additionally, the initial investment and maintenance costs of a chipper without a dedicated engine are significantly less than a traditional tow-behind chipper.

Is your chipping work primarily off-road? PTO chippers are available in several sizes (the Morbark M8D, M12R, and M15R models), equipped with 3-point hitch lifting packages, adjustable to fit a variety of equipment with PTO capability (primarily agricultural-type tractors). Off-road towing packages are also available on these models.

Bio-Fuel & Electric: Fuel for the Near Future

On the leading edge of clean-energy development, organic fuels like methane, digester gases, syngas, and plant-derived alcohols offer several advantages to their fossil-fuel counterparts. Taking advantage of natural fuel sources enables smart companies to cut costs while simultaneously reducing their carbon footprints. The low cost and ever-increasing availability of biofuels make them attractive from a practical standpoint; and their reduced emissions, renewability, and carbon-offset characteristics help our tree care customers meet their sustainability goals and fulfill regulatory emission requirements.

As electric power technology and support infrastructure continue to develop, Morbrk also envisions electric power solutions for its equipment. Stationary electric-powered alternatives to fossil fuel units have been available for years on our equipment. The next level of research and development is to make electric-powered equipment mobile. Our ultimate goal is to provide our customers with the lowest possible operating costs without sacrificing performance or Morbark reliability.

Alternative-fuel-powered equipment from Morbark can help you meet these goals:

- Reduced emissions
- Reduced noise levels
- Similar performance and output to diesel
- Reduced fuel costs
- Reduced operational costs (less maintenance and downtime)

Did you know...

Diesel Exhaust Fluid (DEF) is 32.5% urea and 67.5% deionized water. While Selective Catalytic Reduction (SCR) systems are designed to provide heating for DEF tanks and supply lines, DEF can freeze at temperatures 12° F or lower. Make sure DEF storage containers are kept in locations to prevent freezing so you can pour it when needed!

3.0 L ENGINE

3.0 L ENGINEERING DATA

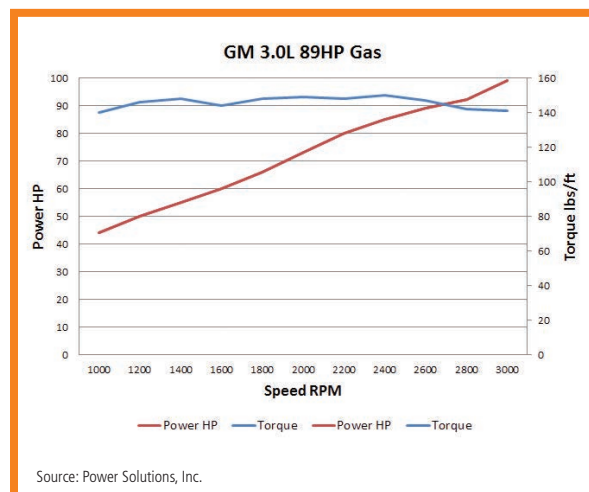
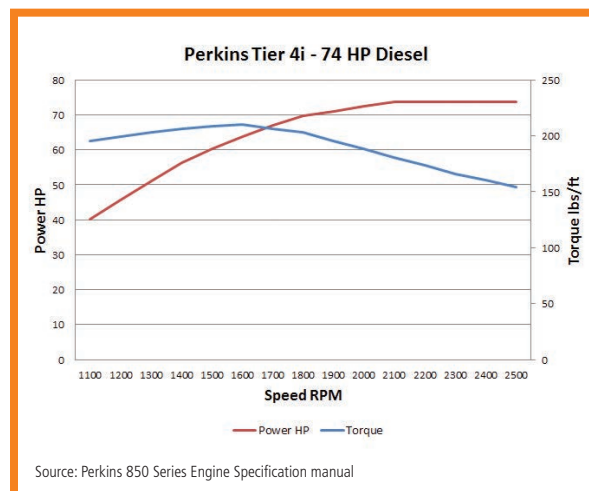
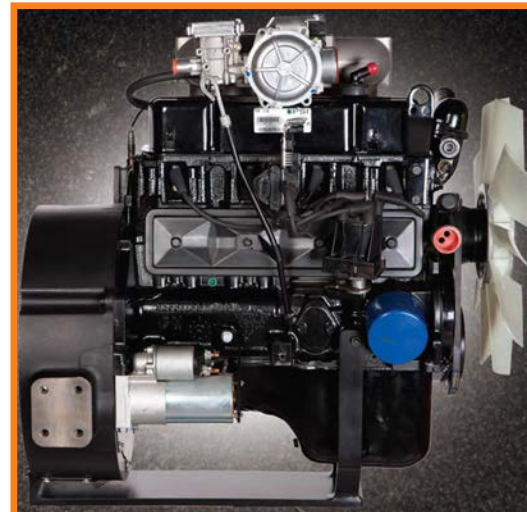
Displacement	181 cid (2966.59 cc)
Bore x Stroke	4.00 in x 3.60 in 101.60 mm x 91.44 mm
Compression Ratio	8.2:1, 9.25:1, or 10.5:1
Fuel Types	NG, LP, Gasoline
HP	89 @ 2,600 RPM
Emissions	Certified through 2015

FEATURES

- Designed to work with gasoline and LP
- High-silicon pistons for improved durability and noise reduction
- Sintered powdered-metal exhaust valve seat inserts for enhanced durability
- World-class engine sealing system for superior leak protection
- Integral harmonic balancer/crankshaft pulley for easier accessory drive dress
- High Energy Ignition (HEI) distributor and coil are standard
- Intake/exhaust manifolds standard on engine
- GM Powertrain industrial engines are available to accept either over-center or automotive-style clutches

OPTIONS

- Fuel options: LPG and Gasoline
- Sequential Electronic Fuel Injection (SEFI) for Gasoline
- Fuel and Emission Control System that meets Tier III EPA/CARB Emission Regulations for LSI Engines
- SAE flywheel housings and flywheels
- Additional crankshaft pulleys
- Instrument panel with auto-shutdown devices
- Sheet metal enclosures
- Cooling fans
- Radiator
- Dry-type, dual-stage, industrial air cleaners
- Electronic governors



Operating Cost Comparison of Beaver™ M12R with 74HP Tier IV Diesel Engine vs. 89HP Gasoline/LPG

	Diesel	Gasoline	LPG
Fuel Consumption per hour @ 50% load factor	1.61 gallons/hr	2.1 gallons/hr	2.12 gallons/hr (8.95 lbs/hr)
Fuel x 2,500 hours (five years)	4,025 gallons	5,250 gallons	5,300 gallons (22,366 lbs)
Total Fuel Cost for 2,500 hours	\$15,496.25	\$18,480.00	\$16,324.00
DEF* Consumption per hour	.05 gallons/hr	N/A	N/A
DEF* x 2,500 hours (five years)	125 gallons	N/A	N/A
DEF* cost for 2,500 hours (five years)	\$735.00	N/A	N/A
Machine and fuel costs divided over 2,500 hours	\$24.47/hr	\$22.14/hr	\$21.28/hr

*Diesel Exhaust Fluid (DEF) is an emissions control liquid required by modern diesel engines. It is injected into the exhaust stream for the purpose of removing harmful NOx emissions from diesel engines.

LET'S CRUNCH THE NUMBERS

- Initial investment for 89-HP Gasoline/LPG engine is \$8,070.00 (18%) less than Tier IV diesel engine.***
- Hourly cost for 89-HP Gasoline/LPG engine is approximately 10% less than Tier IV diesel engine when using gasoline.**
- Hourly cost of 89-HP Gasoline/LPG engine is approximately 13% less than Tier IV diesel when using LPG.**
- HP/torque rating when using LPG is less than 5 – 8% different from gasoline.

Did you know...

DEF cannot have additives to improve performance or prevent freezing – it is critical to maintain the exact urea/deionized water balance. Contamination caused by careless refilling of DEF tanks or storing DEF in containers that previously held other liquids (such as anti-freeze or oil) can damage the SCR system, possibly voiding warranty and potentially costing thousands of dollars!

**Estimates are based on August 2014 fuel prices in United States. Hourly fuel consumption is based on information provided by engine suppliers and calculating load factor at 50%. Actual fuel consumption may vary depending on engine and machine options, maintenance and size/species of wood being chipped.

***Based on January 1, 2015, pricing. Pricing is subject to change without notice.

4.3 L ENGINE

4.3L ENGINEERING DATA

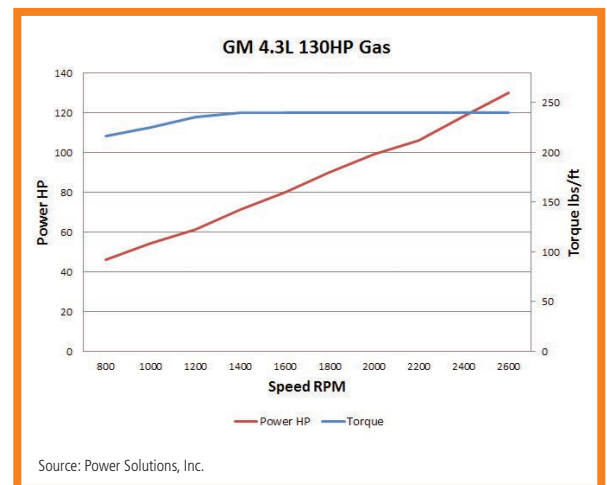
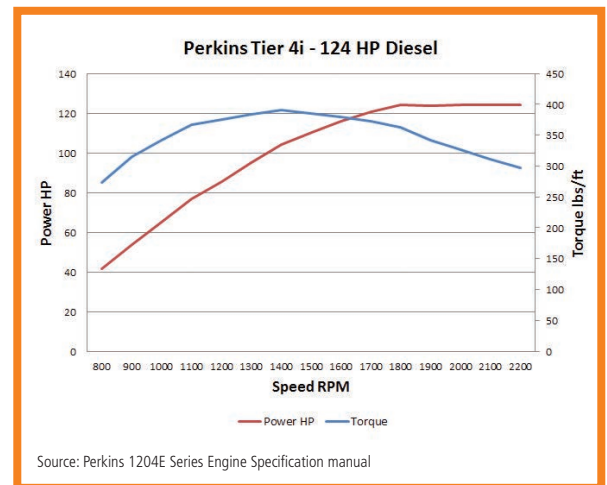
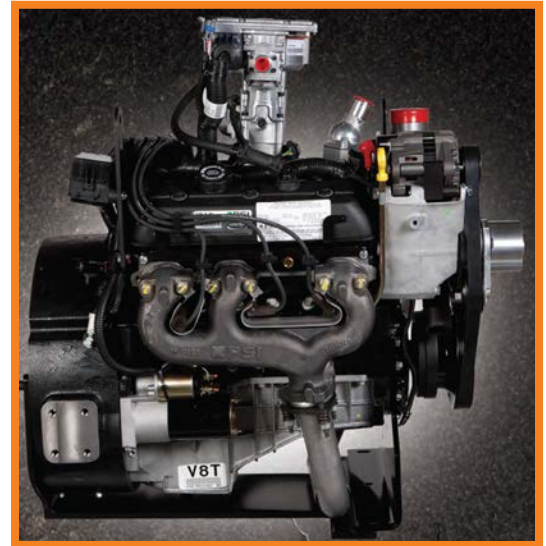
Displacement	262 cid (4294.18 cc)
Bore x Stroke	4.00 in x 3.48 in 101.60 mm x 88.39 mm
Compression Ratio	9.4:1
Fuel Types	NG, LP, Gasoline
HP	130 @ 2,600 RPM
Emissions	Certified through 2015

FEATURES

- Designed to work with gasoline and LP
- Roller valve lifters for reduced friction and improved fuel economy
- Nodular iron crankshaft with undercut and rolled fillets for durability
- Counter-rotating balance shaft for smooth performance and low noise
- Completely component painted
- Composite rocker arm cover and front cover for noise reduction
- World-class engine sealing system for superior leak protection
- Standard High Energy Ignition (HEI) distributor and coil
- Cast-aluminum oil pan for increased strength and noise reduction
- GM Powertrain industrial engines are available to accept either over-center or automotive-style clutches

OPTIONS

- Fuel options: LPG and Gasoline
- Fuel and Emission Control System that meets Tier III EPA/CARB Emission Regulations for LSI Engines
- SAE flywheel housings and flywheels
- Auxiliary drive pulleys available
- Cooling fans
- Radiator
- Dry-type, dual-stage, industrial air cleaners
- Electronic governors
- Sintered powdered-metal exhaust valve seat



Operating Cost Comparison of Beaver™ M15RX with 124-HP Diesel Tier IV Engine vs. 130-HP Gasoline/LPG

	Diesel	Gasoline	LPG
Fuel Consumption per hour @ 50% load factor	2.6 gallons/hr	2.55 gallons/hr	2.61 gallons/hr (8.95 lbs/hr)
Fuel x 2,500 hours (five years)	6,500 gallons	6,375 gallons	6,525 gallons (22,366 lbs)
Total Fuel Cost for 2,500 hours	\$25,025.00	\$22,440.00	\$20,097.00
DEF Consumption per hour	.07 gallons/hr	N/A	N/A
DEF x 2,500 hours (five years)	195 gallons	N/A	N/A
DEF cost for 2,500 hours (five years)	\$1,146.00	N/A	N/A
Machine and fuel costs divided over 2,500 hours	\$33.83/hr	\$28.37/hr	\$27.44/hr

*Diesel Exhaust Fluid (DEF) is an emissions control liquid required by modern diesel engines. It is injected into the exhaust stream for the purpose of removing harmful NOx emissions from diesel engines.

LET'S CRUNCH THE NUMBERS

- Initial investment for 130-HP Gasoline/LPG engine is \$9,915.00 (17%) less than Tier IV diesel engine.***
- Hourly cost for 130-HP Gasoline/LPG engine is approximately 16% less than Tier IV diesel engine when using gasoline.**
- Hourly cost of 130-HP Gasoline/LPG engine is approximately 19% less than Tier IV diesel when using LPG.**
- HP/torque rating when using LPG is less than 5 – 8% different from gasoline.

Did you know...

Tier-IV-compliant engines are not designed for long engine idle periods. Extended engine idling can cause soot build-up in Diesel Particulate Filters (DPF), requiring more frequent regeneration and shortened filter life. Too much idling can also cause DEF to crystallize in the injectors, causing problems.

**Estimates are based on August 2014 fuel prices in United States. Hourly fuel consumption is based on information provided by engine suppliers and calculating load factor at 50%. Actual fuel consumption may vary depending on engine and machine options, maintenance and size/species of wood being chipped.

***Based on January 1, 2015, pricing. Pricing is subject to change without notice.



In 1957, Norval Morey, a local sawmill operator, took the first risky step into manufacturing – armed with a patent for a portable pulp wood debarker. The Morbark[®] Debarker Company was born, and nobody in Winn, Michigan, could have predicted the growth that the company would experience over the next five decades and beyond. From a simple blacksmith shop to a 1.1-million-square-foot manufacturing complex. From two workers to more than 500 employees. From one product to hundreds of heavy equipment designs. These are some of the important milestones in Morbark's remarkable history.

With more than 50 years of ideas, invention, and phenomenal growth, Morbark is recognized as a world-class manufacturing company with worldwide markets and a reputation for designing and building robust, rugged, and reliable heavy equipment.

Over the decades, we've moved to the next level again and again. We'd like to help you expand and move forward at the right pace for your business. No matter what your size is today – or where you want to be in the future – Morbark can be your partner and source for unmatched equipment, industry experience, and guidance.

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