HFE INTERNATIONAL

DA215B EFI Data Sheet

HFEDCN0787 Rev C

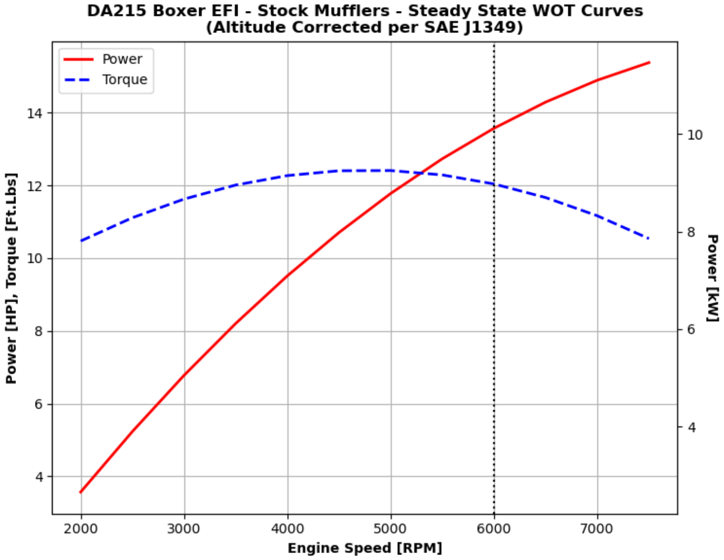

Figure 1: Power curve generated from steady state wide open throttle conditions from 2000 RPM to 7500 RPM in 500 RPM increments. Measured torque was averaged over 30 seconds at each RPM, accounting for all high/low torque spikes that are present in normal operating conditions.

	METRIC	**IMPERIAL**
DISPLACEMENT	215 cc	13.1 ci
MAX POWER (7500 RPM)*	11.4 kW	15.3 HP
MAX TORQUE (4500 RPM)*	16.9 Nm	12.4 lbft
CONTINUOUS POWER (6000 RPM)*	10.2 kW	13.6 HP
CONTINUOUS TORQUE (6000 RPM)*	16.1 Nm	11.9 lbft
OPERATING RPM RANGE	2000 RPM to 8000 RPM	
AVERAGE BSFC	524 g/kWh	0.86 lb/HPh
WEIGHT (ENGINE WITH THROTTLE BODY)	5.59 kg	12.3 lb
WEIGHT (ECU)	110 g	3.88 oz
WEIGHT (FUEL PUMP)	150 g	5.29 oz
WEIGHT (IGNITION)	135 g	4.76 oz
WEIGHT (WIRE HARNESS/ FUEL LINES)	350 g	12.3 oz
FUEL**	Any Grade Pump Gasoline	
TWO STROKE OIL	Red Line, 40:1 Mixture	
REQUIRED OPERATING VOLTAGE	10V to 15V	
CURRENT DRAW	2A Peak	
RECOMMENDED BATTERY	3s or greater LiPo, 1 hour / 1000 mAh	
AMBIENT TEMPERATURE RANGE	-15° to 66° C	5° to 150° F

*Stock Muffler **No heavy fuel option at this time

Propeller Recommendations

2-Blade	**Max RPM ± 200**	**Estimated Max Thrust (lbs) ±10%**	**3-Blade Mejzlik**	**Max RPM ± 200**	**Estimated Max Thrust (lbs) ±10%**
28x12	6900**	73.2**	28x12	6200*	73.9**
29x10	6700**	73.2**	29x12	6100*	73.0**
32x18	4500**	64.2**	30x13	5400*	70.8**

*Recorded from static test stand **Estimated via simulation

Part Throttle Power and Torque

Part throttle curves were generated by operating the engine at steady state using a Magtrol eddy current dynamometer. Torque and speed data was captured for 30 seconds at each throttle position and speed point. Low throttle cut off points were determined by the engines ability to produce torque at a given speed; as speed increased higher starting throttle positions were required. Each trace represents constant throttle position, starting at 20% throttle (bottom trace) to 100% throttle (top trace). All data points are ±10% to account for measurement error and engine to engine variation. Test details are available upon request.

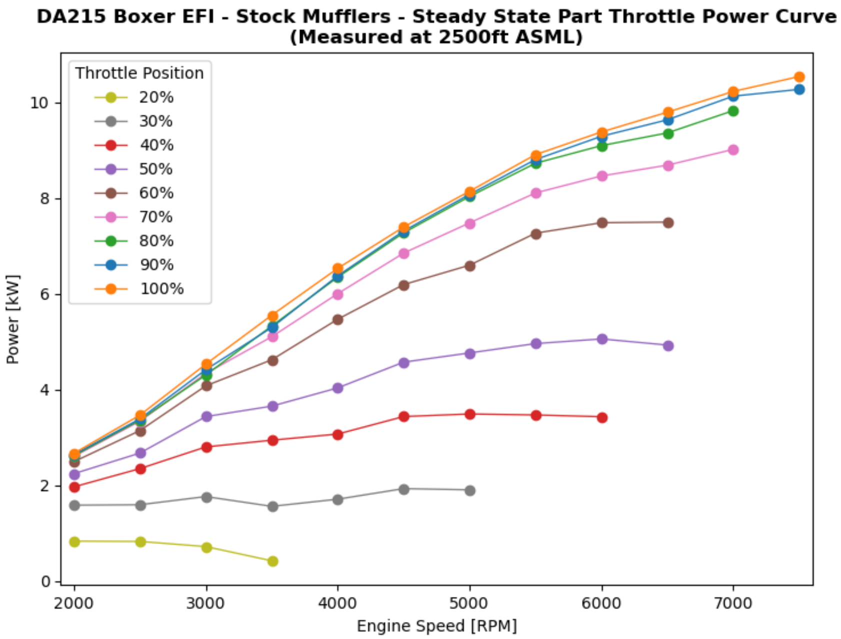

Figure 2. Part throttle power curves

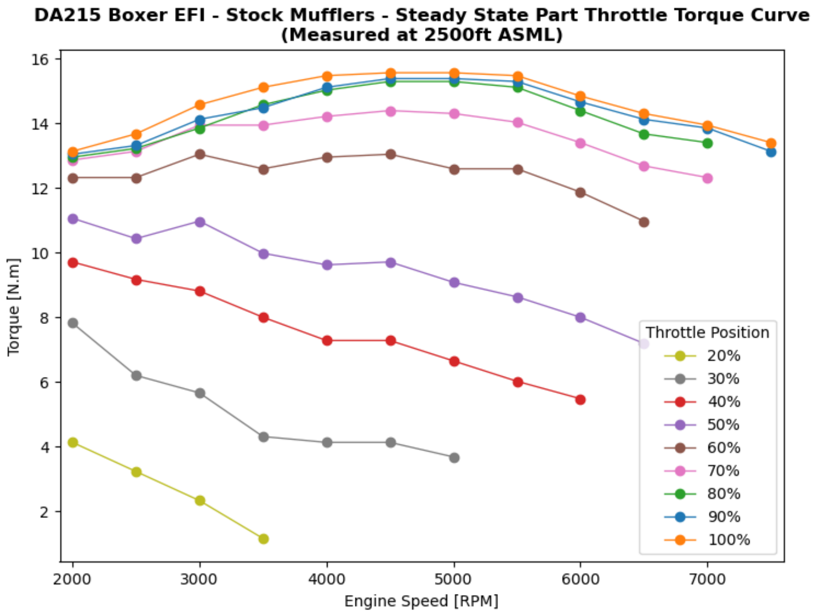

Figure 3. Part throttle torque curves

Power Degradation as a function of Manifold Air Temperature (MAT) or Cylinder Head Temperature (CHT)

It is common for an engine to experience reduced thermal efficiency with increased charge air temperature and/or increased cylinder wall temperature resulting in reduction of brake power. HFE EFI systems monitor these two temperate points using MAT and CHT thermistors. The EFI compensates for ΔT of either or both sensors by increasing or decreasing injector pulse width to maintain proper AFR, although power loss is still experienced. Power degradation was measured using a Magtrol eddy current dyno by maintaining constant CHT (235F), altering MAT or constant MAT (80F), and altering CHT. Engine was held at steady state, 4500 RPM, 100% throttle for both tests. Optimal continuous operation temperature range 200-240F CHT, and 60-90F MAT.

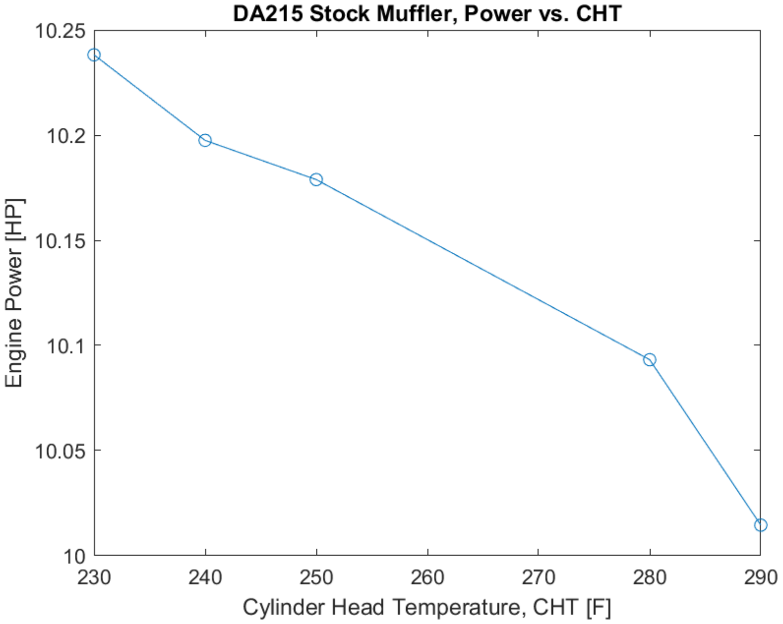

Figure 4. Power loss due to CHT is 0.09 HP / °F (65.8 W / °F); optimal CHT is 200-240F

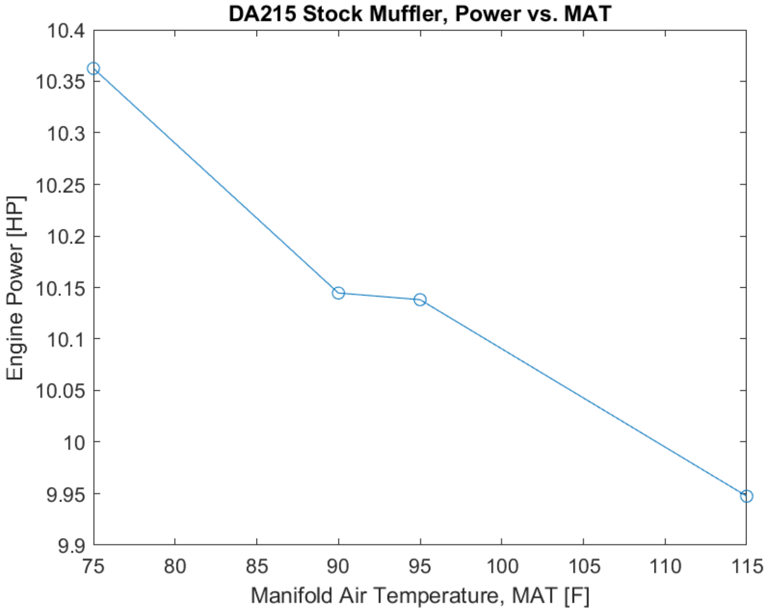

Figure 5. Power loss due to MAT is 0.17 HP / °F (126.8 W / °F); optimal MAT is 60-90F

Brake Specific Fuel Consumption (BSFC)

Fuel consumption was measured (10Hz sample rate) via gravimetric analysis at a steady state for 30 seconds simultaneously with torque measurements. The relationship between BSFC and engine speed at wide open throttle (WOT) is shown (Figure 6); engine is most efficient around maximum brake torque, 2500 - 3500 RPM for the DA 215 EFI. BSFC contours are shown (Figure 7) in relation to engine torque and speed; this is useful for estimating regions of torque and speed having a near constant BSFC. Additional BSFC vs. speed plots at a given throttle position are available upon request.

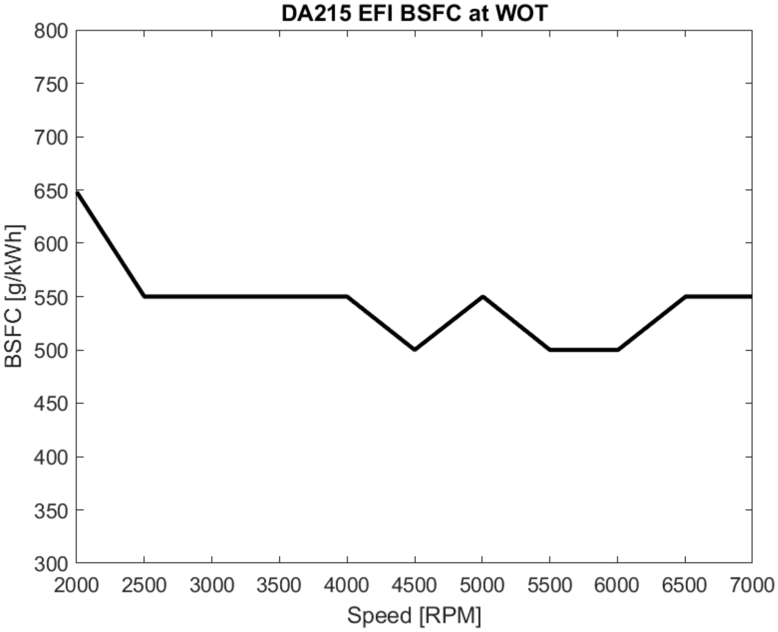

Figure 6. BSFC as a function of RPM

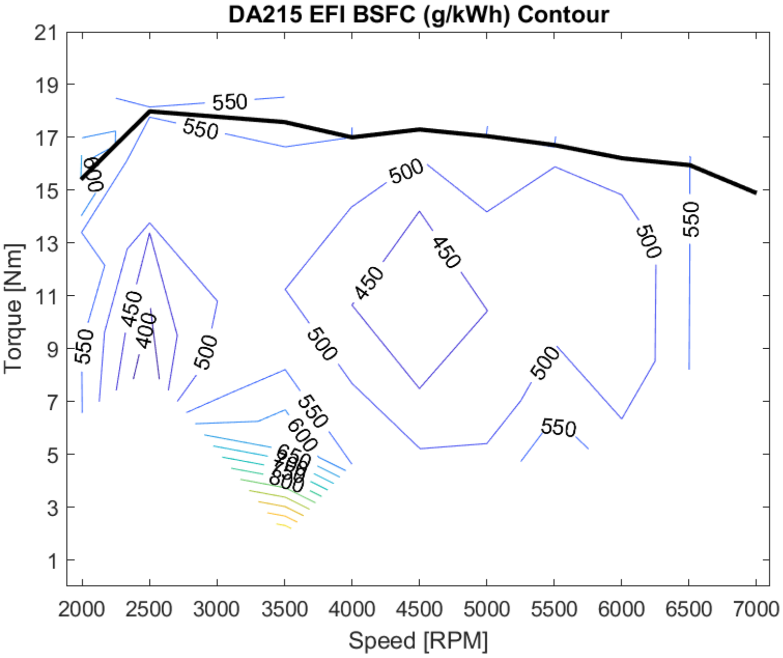

Figure 7. BSFC contours within regions of engine torque and speed

Stock Muffler Acoustic Analysis

Acoustic data was measured using a thirty-two-microphone array, positioned ~0.85 meters from the engine exhaust tip. A-weighted sound pressure from each microphone was averaged at a given frequency, then the equivalent sound pressure was calculated across a frequency range of 100Hz to 10kHz, to produce a single decibel level of the exhaust at a specific engine speed and throttle position. Figure 8 shows the results of this analysis at four throttle positions across the engine's speed range (1500 to 8500 RPM) where applicable.

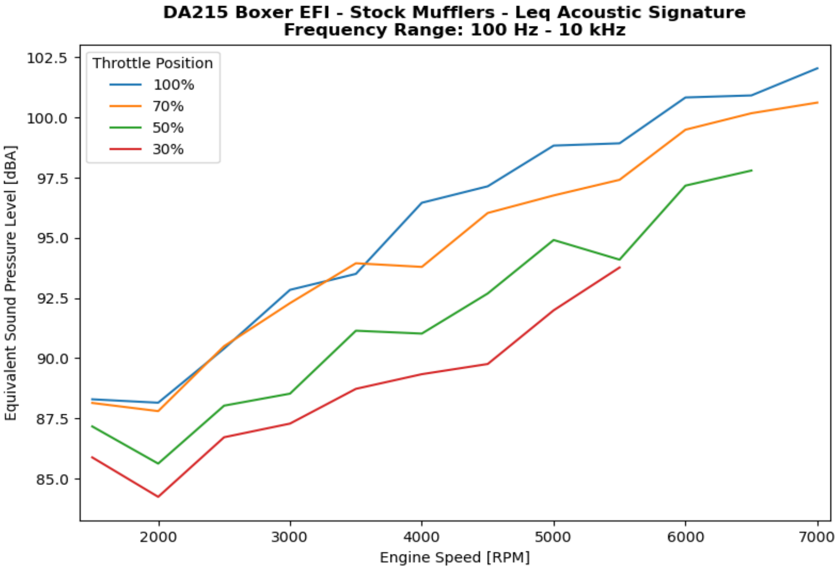

Figure 8. A-weighted equivalent sound level at four throttle positions, observer ~0.85 meters from engine.

Altitude attenuation is used to approximate the engine exhaust dBa over an increasing altitude gradient assuming that the observer is directly underneath the aircraft. Isohumidic plots of sound level vs. altitude are shown for various throttle positions across a range of engine speeds. Note that an ambient relative humidity of 50% is assumed, and a higher relative humidity would lead to slightly more acoustic attenuation & vice versa for a lower relative humidity.

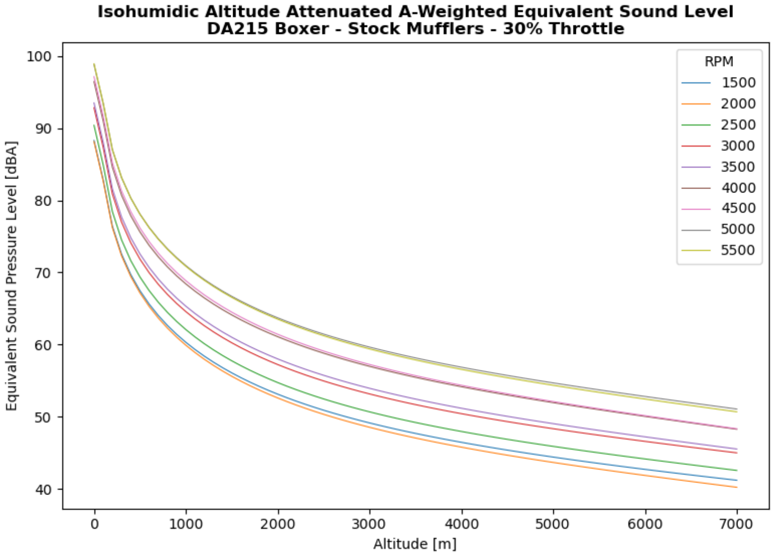

Figure 9. IsoHumidic plot for engine at 30% throttle and varying speeds.

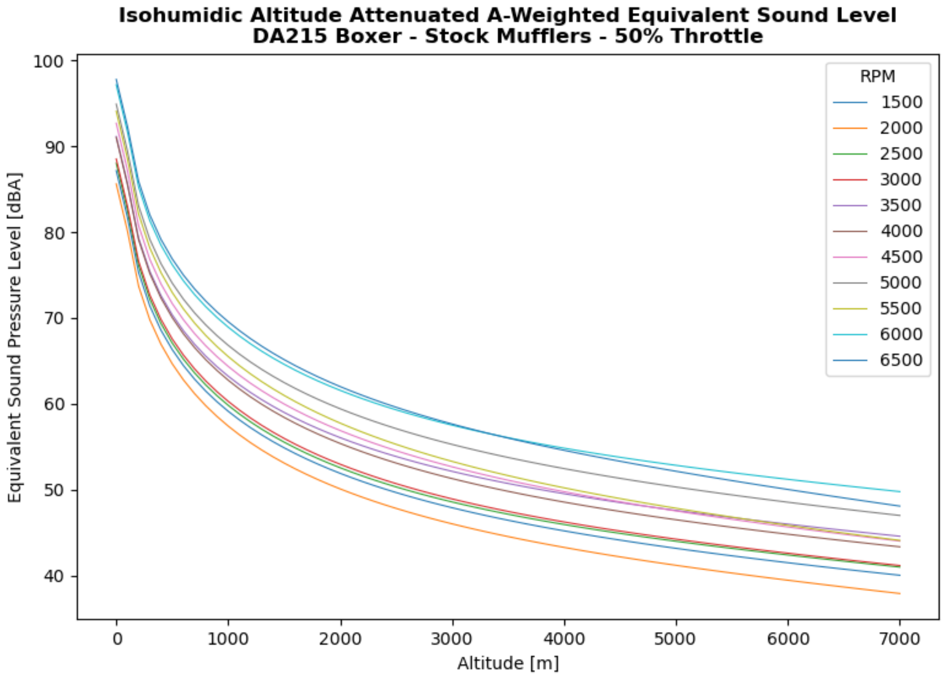

Figure 10. IsoHumidic plot for engine at 50% throttle and varying speeds.

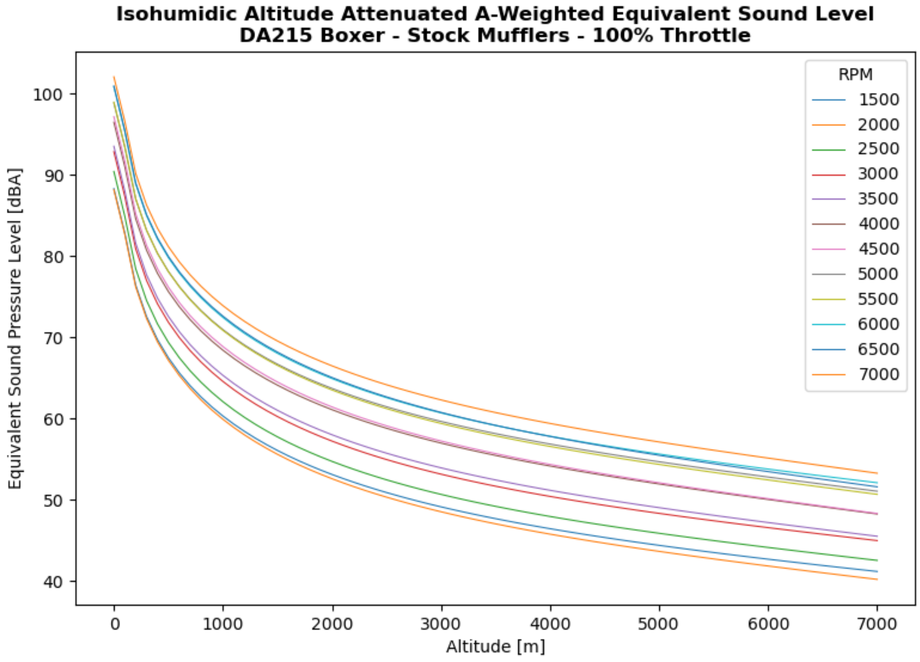

Figure 11. IsoHumidic plot for engine at 100% throttle and varying speeds.

Additional altitude attenuation plots and frequency plots are available upon request.

Maximum Power and Maximum Rated RPM Disclaimer

HFE provides the data in this sheet with the following exceptions:

- Maximum RPM can change between propeller manufacturers even if it is the same pitch and diameter. Propeller mass, balance, surface condition, chord shape, and tip shape, vary between manufacturers.
- Surface condition and defects in the propeller can change maximum RPM.
- Rigid vs. soft mounting the engine will change maximum RPM values.
- Engine to engine tolerance stack up for piston and bore clearance, casting variations and bearing fit can result in a +/- 3% variance in maximum RPM from engine to engine. HFE does not claim or warrant that all engines delivered will have the same maximum power. Engineers should design for the +/- 3% of the rated RPM in this data sheet.
- Generator loads can reduce maximum RPM by levels much higher than the power curve may state because there are other losses in the generator and PMU system that should be considered.
- It is common knowledge that two strokes can reduce RPM after being held at full throttle for several seconds. Initial full throttle RPM reduces because the piston expands with heat and becomes tighter in the bore, increasing friction. The expected drop from the instant high RPM, is approximately 200 RPM and varies depending on the propeller load.
- Increases in altitude will reduce air density in the engine resulting in lower power, however the work required to turn the propeller will also reduce. This relationship will vary depending on the propeller design. In some cases, the RPM will increase with higher altitude, and in some cases the RPM could decrease with higher altitude.
- Changes in intake air temperature and cylinder head temperature can affect maximum RPM.
- If the customer changes the location of the engine crank position sensor, maximum RPM can change and possibly damage the engine.
- Engine break in can cause RPM to increase slightly over time.
- Changing the muffler will change engine performance. Any change in the muffler should be coordinated with HFE otherwise the warranty is void.
- Changes in fuel, oil type and oil to fuel ratio can affect maximum RPM