

GENPOD® 70

HFE INTERNATIONAL

OWNER'S MANUAL



HFEDCN0418
Revision B



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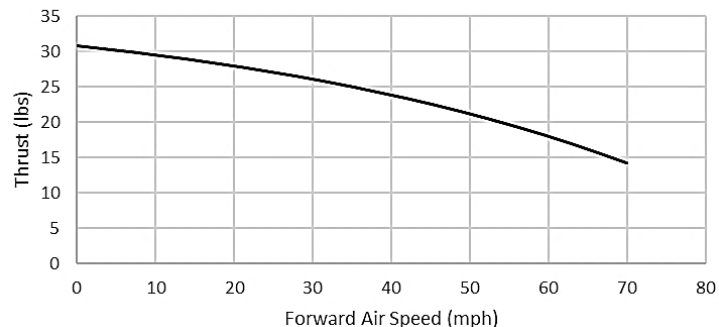
Document Revision Table

| Rev | Description of change | Revised by | Revision Date | Approved By | Approved Date |
|-----|-----------------------|------------|---------------|-------------|---------------|
| A | Initial Release | TWest | 10/02/19 | DMcclain | 10/02/19 |
| B | Peer Review Revisions | TWest | 9/13/21 | DRB | 9/13/21 |
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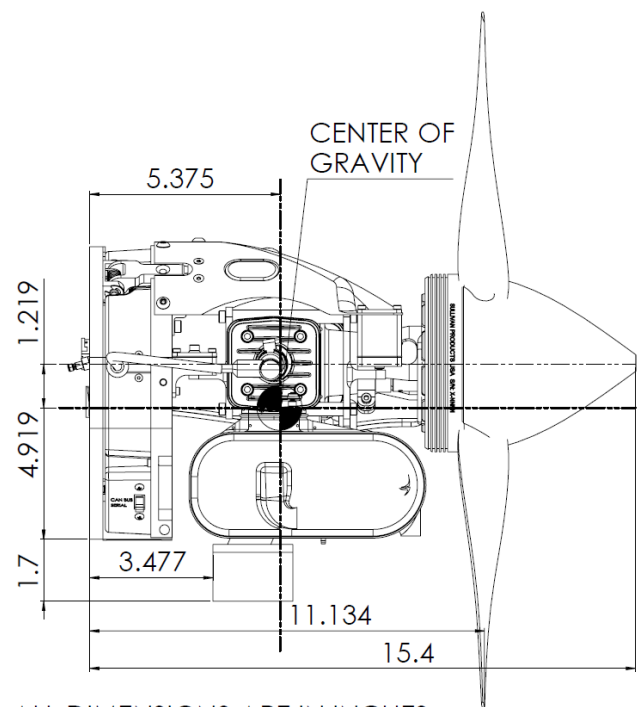
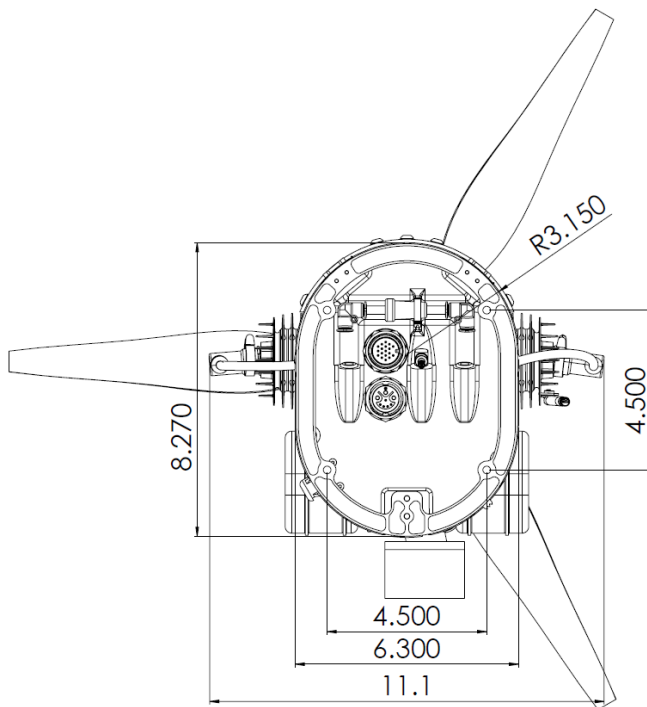
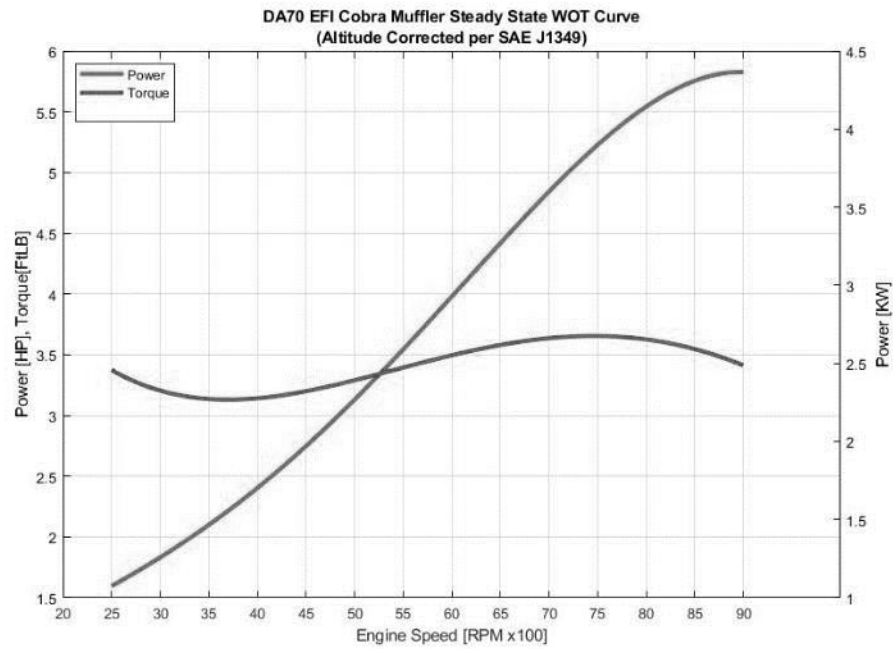
SPECIFICATIONS

| Metric | Value (SI) | Value (SAE) |
|-----------------------------------|------------------------|--------------------------|
| Actual displacement | 70 cc | 4.27 in ³ |
| Momentary Peak Power @ rated RPM | 4.5 kW@ 9000 RPM | 6.0 hp @ 9000 RPM |
| Max Continuous Power | 3.71 kW@ 7000 RPM | 5 hP @ 7000 RPM |
| Peak Torque @ RPM | 5 N-m @ 7500 RPM | 3.7 ft-lb @ 7500 RPM |
| Max Torsional Impulse | 29 N-m | 21.6 ft-lb |
| Cruise BSFC @ RPM | 437 g/kW-hr @ 6000 RPM | 0.72 lb/hp-hr @ 6000 RPM |
| Idle BSFC @ RPM | 732 g/kW-hr @ 3000 RPM | 1.2 lb/hp-hr @ 3000 RPM |
| Do Not Exceed Max RPM | 9000 RPM | 9000 RPM |
| Rated (useable) Max RPM | 8300 RPM | 8300 RPM |
| Standard Operating RPM Range | 3000 - 7500 RPM | 3000 - 7500 RPM |
| Full System Weight with mufflers | 5.06 kg | 11.15 lb |
| Full System Power to Weight Ratio | 0.9 kw/kg | 0.54 hp/lb. |
| Nominal Current Draw (12V) | 0.5 A | 0.5 A |
| Maximum Current Draw (12V) | 1 A | 1 A |
| Rated Max CHT | 130 °C | 270 °F |
| Do Not Exceed CHT | 190 °C | 375 °F |
| CHT after warm up | 93 °C | 200 °F |
| Rated Ambient Minimum | -18 °C | 0 °F |
| Rated Ambient Maximum | 49 °C | 120 °F |
| Nominal Dynamic Compression | 8.3 bar | 120 psi |
| Compression Ratio | 8.5 : 1 | 8.5 : 1 |
| Time between overhauls | 300 Hrs | 300 Hrs |
| Sound Level | 91 dBA at 1 meter | 91 dBA at 3 feet |

Max Thrust at 7000 RPM (lbs)
20 x 10 3 Blade



GenPod™ 70 comes with a 20 X 10 3 blade propeller. However other props may be used at the customers discretion. Note: See Appendix for additional propeller data.



ALL DIMENSIONS ARE IN INCHES

SAFETY PRECAUTIONS

General Safety

Read and understand this Owner's Manual before operating your engine. You can help prevent accidents by being familiar with the controls and observing safe operating procedures.

Operator's Responsibility:

1. The operator should know how to stop the engine quickly in case of an emergency.
2. A safety zone of 3 feet around the propeller should be established in which no person or object is allowed to enter. Install a guard around the propeller when appropriate.




WARNING

1. Observe all safety precautions when working around the propeller.
2. Exhaust contains poisonous carbon monoxide, a colorless and odorless gas. Breathing carbon monoxide can cause loss of consciousness and may lead to death.
3. Never run your engine in an enclosed space. Always allow for appropriate ventilation.
4. Observe precaution around the muffler. The exhaust system gets hot enough to ignite some materials.
5. Keep flammable materials away from the engine.
6. Gasoline is extremely flammable and is explosive under certain conditions. Do not smoke or allow flames or sparks where the engine is operating.

FUEL REQUIREMENTS

Engine Oil

This engine was calibrated using Red Line 2 Stroke Racing oil at a mix ratio of 40:1. This oil type and mix ratio should be maintained to ensure that the fuel injection system and engine operates as designed. If Redline oil is not available, use an equivalent 2T quality two stroke oil for best results.

| | |
|--|---|
| Oil Brand: Red Line Oil Type: 2 Stroke Racing Oil |  |
| Mix Ratio: 40:1 40 parts gasoline to one part oil by volume. | |

Fuel Recommendations

The engine was calibrated with standard 87 octane gasoline. Customers may use higher octane fuel if desired. Non-leaded fuels recommended.

Leaded Fuels Warning: When using leaded fuels, the result will be shorter TBO's as a result of lead oxide coking on cylinder and exhaust ports. Leaded fuels will require cylinder, piston, and port, dressing and inspection every 50 to 100 hours (depending on use case). Cylinder dressing and cleaning should be done by a trained professional or by HFE International.

Note: Non-leaded fuels will not require cylinder dressing and may be used continuously until the suggested TBO.

COMPONENT IDENTIFICATION

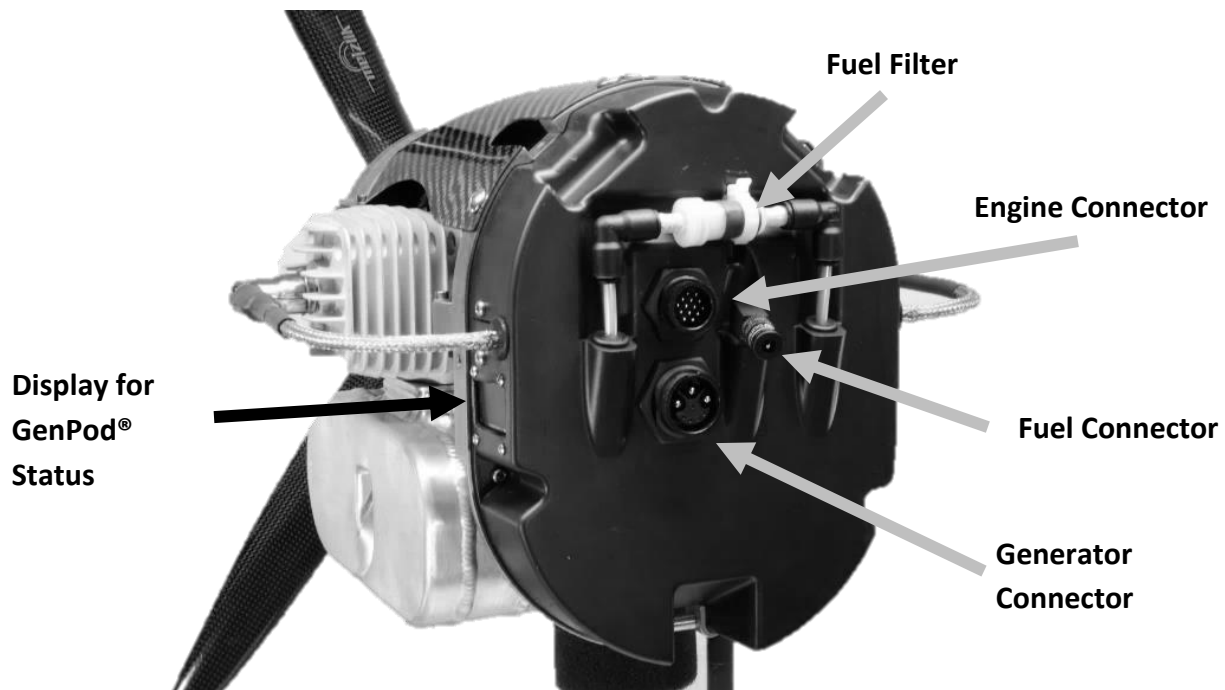


Figure 1. GenPod® Connections and Components

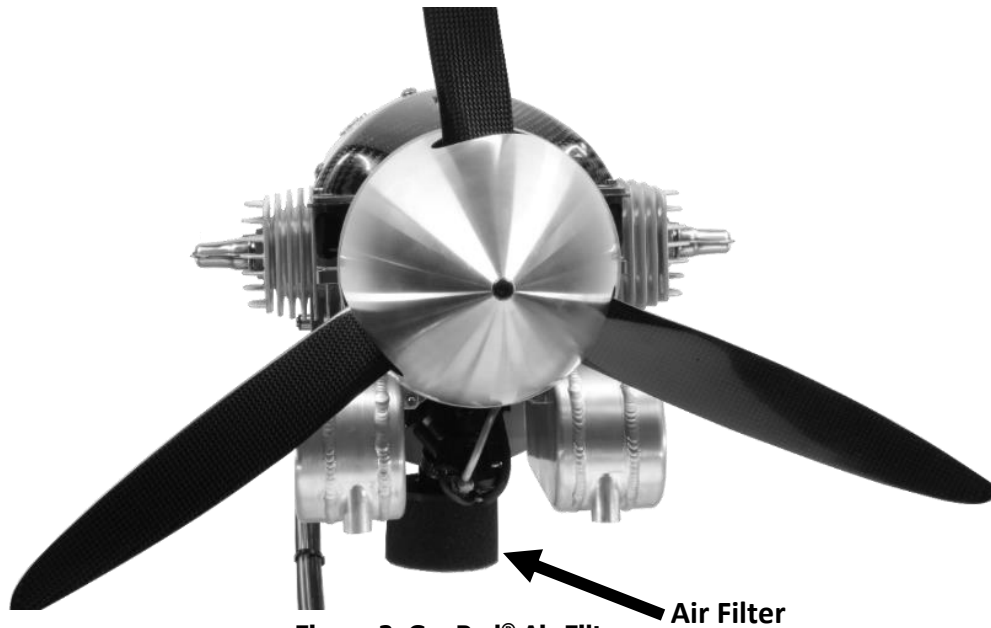


Figure 2. GenPod® Air Filter

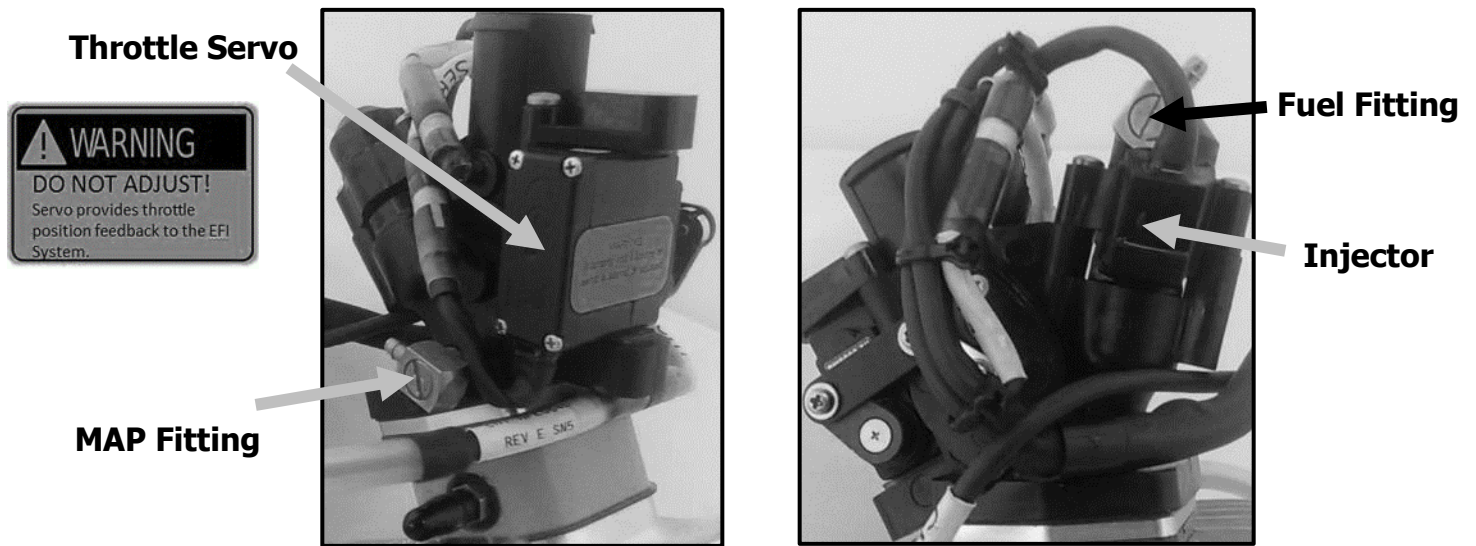


Figure 3. Intake Assembly Components

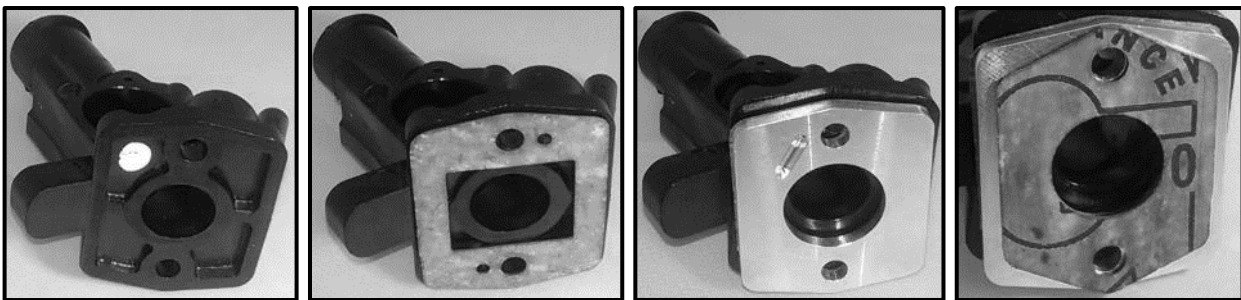
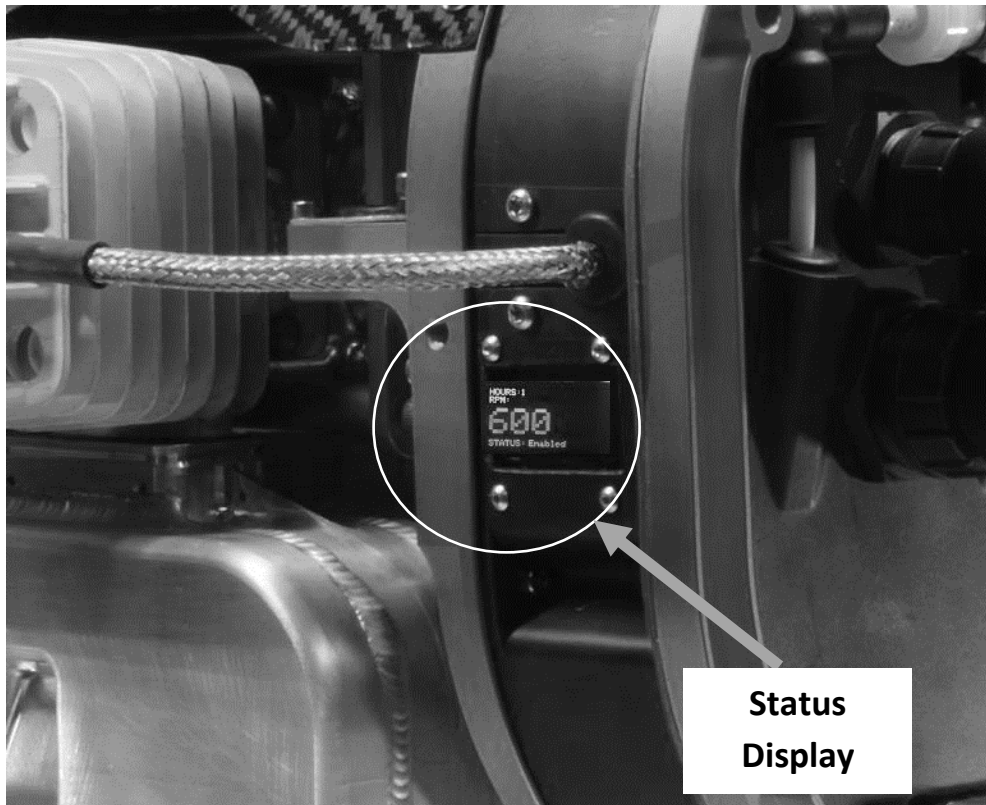


Figure 4. Intake Gasket Order



Faults:

CHT - Cylinder Head

Temperature Sensor Fault

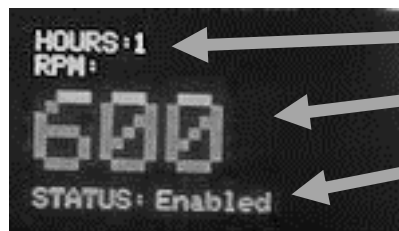
MAT- Manifold air Temperature
Sensor Fault

TPS - No Throttle Command
given or throttle command error

Battery - Power to GenPod® is
too high or too low. See Signal
input limits.

RPM - Crank position sensor
error.

Pump - Fuel pressure problem



Engine Hour Meter

Engine Speed (RPM)

Engine Status (Enabled /
Disabled)



Fault Codes will display in the
place of the standard display.

NOTE: display data will only show in CAN BUS communication mode

INSTALLATION AND STARTING

INSTALLATION

1. Install the GenPod® Interface to your aircraft with 4x M5 flat head screws, ensuring that the attachment can handle up to 23 kg (50 lbs.) of thrust and vibration torque impulses as high as 30 N-m (22 ft-lbs).

Permanently Install
GenPod® Mounting
Interface on Aircraft
with 4x M5 Flat Head
Screws

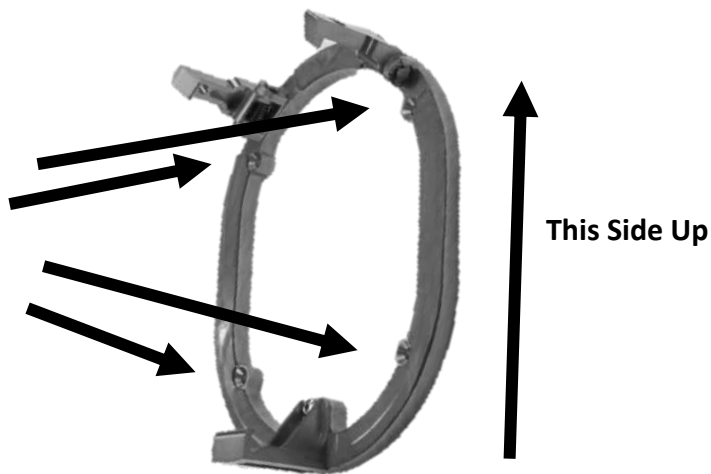
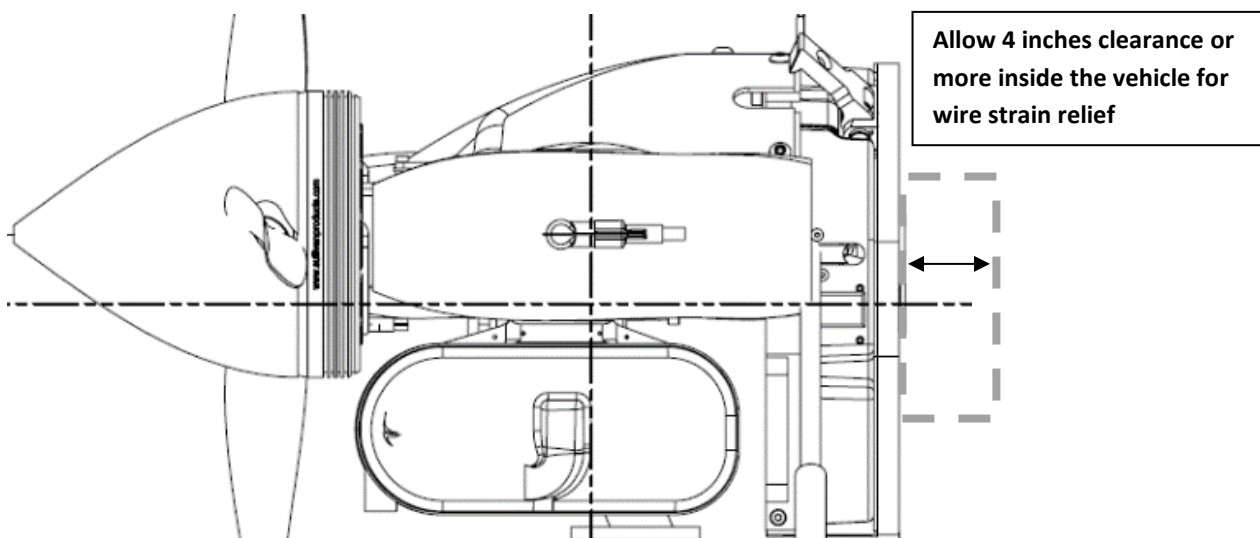


Figure 5. GenPod® Mounting Interface



2. Verify that there is an opening in the center of the GenPod® Interface that allows for the back-shell of the connectors and fuel line to fit once the engine is installed. Verify that there are no sharp edges that the wire harness can chafe on and that the fuel line cannot kink when engine is installed.
3. Connect main harness and PMU inside the aircraft. You may cut and adjust the harness inside the aircraft as needed. Use Mil Spec connectors or similar.
4. Install Engine and fuel connector to the back of the GenPod®.
5. The GenPod® uses a Sullivan PMU and alternator. Connect the PMU harness to the back of the GenPod®.
6. Install the GenPod® to the Interface by resting the pin in the interface hook and latching the two latches on top. Secure the latch with M5 flat head screws before flight.



Figure 6: CAN BUS and Serial Switch

THROTTLE, COMMUNICATION AND ENABLE SETUP

1. Throttle commands use a standard PWM signal. Expected pulse width range from 900 μ s for closed throttle and 2100 μ s for wide open throttle.
2. To change between CAN BUS and Serial communication, slide the switch located on the Genpod[®] cover towards the desired protocol **(Figure 6)**
3. **(Throttle kill)** When the pulse width from the receiver falls below 960 μ s (5% throttle), the ECM will remove power to both the injector and ignition system thus stopping the operation of the engine.
4. **(Enable kill)** Provide 5V power to the enable line, when power is removed ECM will remove power to both the injector and ignition system thus stopping the operation of the engine.



Figure 7. GenPod[®] Fuel Venting

ENGINE STARTING

1. Verify that the throttle setting is at about 30%.
2. Prime your system for the first time by pressing and holding the fuel vent port when the Genpod® power is on (**Figure 7**). Cycle the battery power to the Genpod® in 5 second intervals until fuel is flowing from the vent port without air. You should not have to complete the priming process again unless the engine fuel system is allowed to run dry or has been disconnected for any reason.
3. The engine should be started using an external hand held starter, or using a built-in starting alternator. **Flip starting is an additional option but is not recommended due to possible injuries.**

Note: The engine may struggle to run for the first few minutes as it is purging all the air from the fuel system. This may not be evident until you go to wide open throttle.

4. Allow the engine to run for a few minutes around 3500 RPM.
5. Keep at wide open throttle for 10 seconds to verify that the air in the fuel system has been purged. Reduce the engine speed to idle.

STARTING AGAIN AFTER FIRST START

1. Verify that the throttle setting is at about 30%.
2. The engine should be started using an external hand held starter, or using a built-in starting alternator. **Flip starting is an additional option but is not recommended due to possible injuries.**
3. Allow the engine to run for a few minutes around 3500 RPM.
4. Keep at wide open throttle for 10 seconds to verify that the air in the fuel system has been purged. Reduce the engine speed to idle.

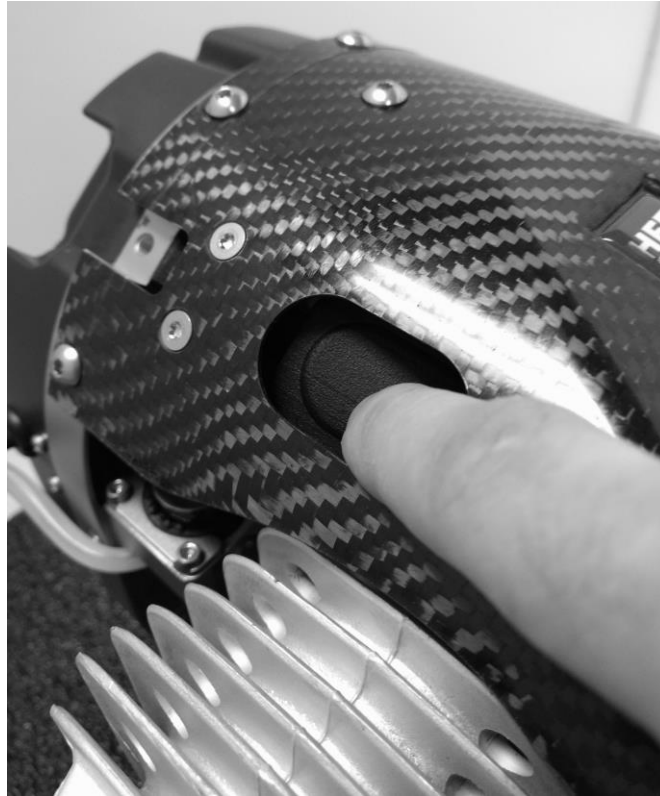


Figure 8: Genpod® Buttons

REMOVING THE ENGINE

1. Remove the M5 flat head screws securing the Genpod® to the latches.
2. Press the buttons as seen in Error! Reference source not found. to lift the latches up. While supporting the Genpod®, lean the Genpod® forward.
3. Disconnect the main harness, the PMU harness, and the fuel connector from the Genpod®.
4. Lift and remove the Genpod®. If the Genpod® is to be shipped, please use the HFE Int. provided packaging.

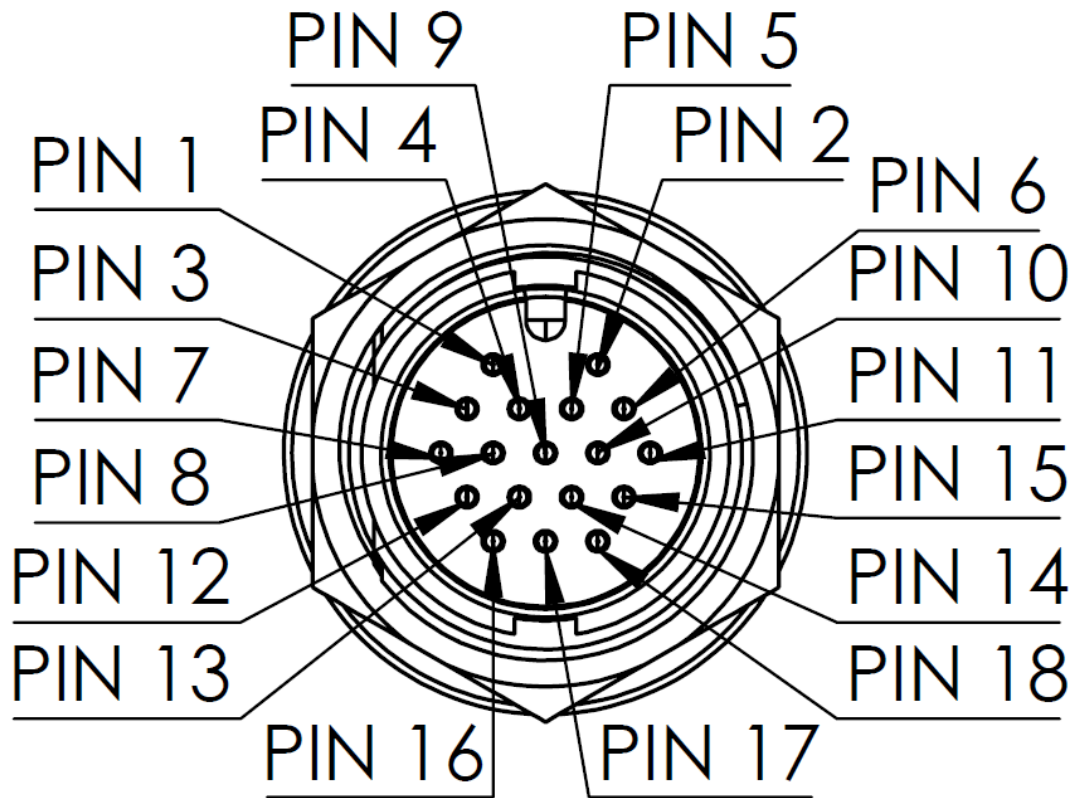
INTERFACE SPECIFICATIONS

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Signal Inputs/Outputs for GenPod® :

| Pin | Signal | Color | Description |
|-----|--|--------------|---|
| 1 | TACH OUT | Brown | +5V logic-level digital output. This pin has a maximum continuous load of $\pm 20\text{mA}$. Output signal has a 50% duty cycle. |
| 2 | TX | Blue | RS-232 Transmit |
| 3 | CAN HI | White | CAN bus signal High |
| 4 | ENABLE (Special feature available on request) | Green | Engine enable signal from Auto Pilot. A 5 volt signal present to enable (UAV option only). This pin has an 8mA draw. 10k pull down resistor. |
| 5 | THROTTLE SIGNAL | Yellow | Throttle position with logic-level input. A Pulse Width Modulated (PWM) signal at nominally 50Hz with ON time ranging from 900 μs to 2100 μs corresponding to throttle position (0% to 100%). This pin has an 8mA draw. |
| 6 | POWER 12V | Gray | Main power input. 10 to 14 volts. Maximum power draw is 12 W at wide open throttle. (11.1v 3 cell LiPo 2000ma or bigger) |
| 7 | RX | Pink | RS-232 Serial Communication Receive |
| 8 | CAN LO | Red | CAN bus signal Low |
| 9 | NC | Black | No Connect |
| 10 | GND (Main Input) | Orange | Main Power Ground |
| 11 | GND | Purple | Serial Communication Ground Reference |
| 12 | GND | Light Green | CAN Ground Reference |
| 13 | GND | Black/White | Enable Ground Reference |
| 14 | GND | Brown/White | PWM Signal ground reference |
| 15 | NC | Red/White | Not connected |
| 16 | GND | Orange/White | Tach Out Ground Reference |
| 17 | GND | Green/White | IOT Ground Reference |
| 18 | POWER 12V | Blue/White | IOT power input. |

Table I: **GenPod® Input Connector 18 Pin**



FRONT OF CONNECTOR

POWER MANAGEMENT UNIT NODE 1

| Pin | Signal | Color | Description |
|-----|------------|--------|--|
| 1 | AC IN 1 | RED | 3 Phase input 30VAC to 85 VAC |
| 2 | AC IN 2 | YELLOW | 3 Phase input 30VAC to 85 VAC |
| 3 | AC IN 3 | BLUE | 3 Phase input 30VAC to 85 VAC |
| 4 | BATTERY + | RED | System battery positive. 6S LiPo 24-30 VDC 150 CCA minimum for starting. Note: LiPo battery charge circuit will enable after engine is running. |
| 5 | BATTERY - | BLACK | System battery negative. |
| 6 | EXTERNAL + | RED | 28V external input. (shore power) Do not exceed 32VDC. |
| 7 | EXTERNAL - | BLACK | External input ground. |

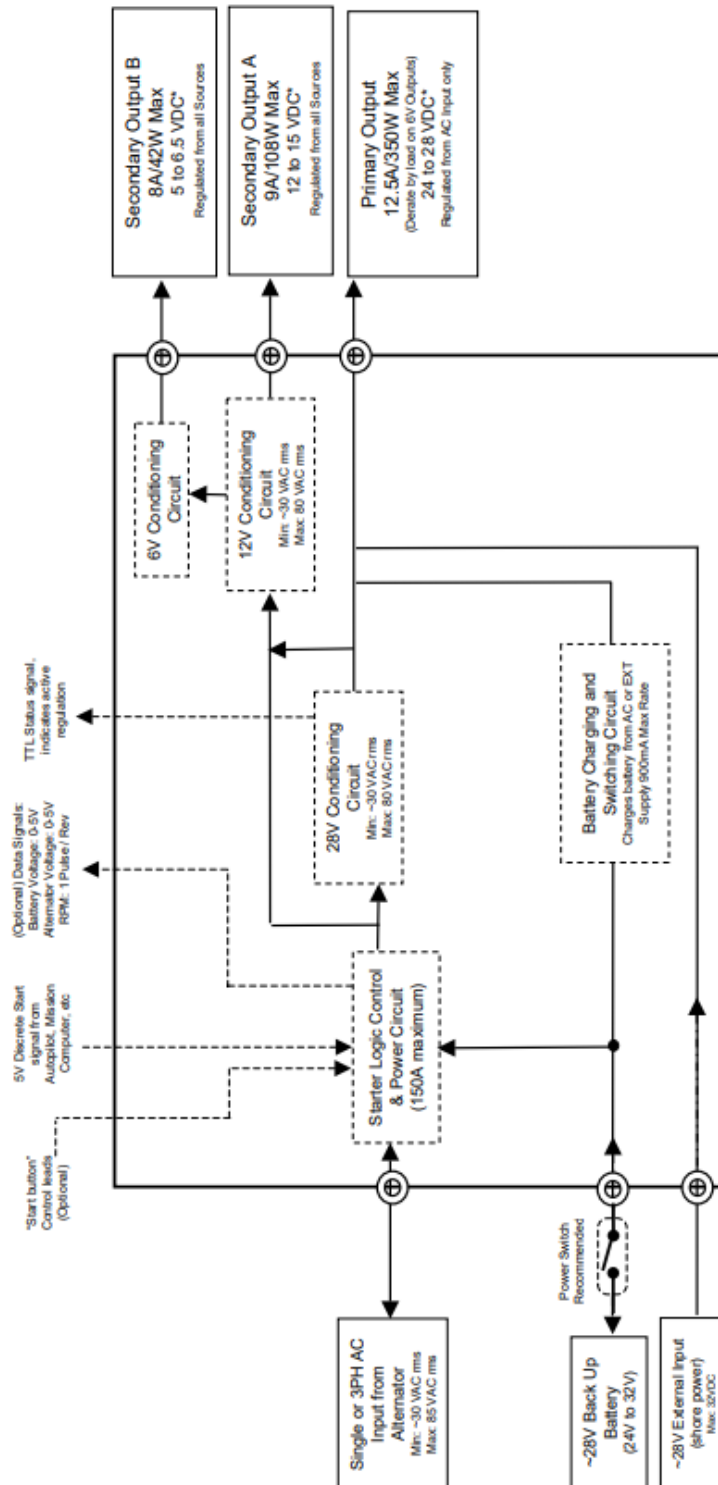
POWER MANAGEMENT UNIT NODE 2

| Pin | Signal | Color | Description |
|-----|----------|-------|---|
| 1 | START + | GREEN | 5V Signal indicates start. |
| 2 | START - | BLACK | Start signal ground reference |
| 3 | STATUS + | RED | TTL status signal indicates active rectification. |
| 4 | STATUS - | BLACK | TTL status signal reference ground |

POWER MANAGEMENT UNIT NODE 3

***NOTE:** Primary, Secondary, and Tertiary outputs can be adjusted, within the range specified, based on customer requirements.

| Pin | Signal | Color | Description |
|-----|-------------|-------|--|
| 1 | PRIMARY + | RED | Primary Output 24 to 28VDC* de-rated by 6V load on outputs. 12.5A/350W maximum output. Regulated from AC input only. Engine must be running for this output to function. |
| 2 | PRIMARY - | BLACK | Primary Ground Reference |
| 3 | SECONDARY + | RED | Secondary output = 12 to 15VDC* with 9A/108W maximum output. This output is powered at all times when battery is connected to PMU. |
| 4 | SECONDARY - | BLACK | Secondary Ground Reference |
| 5 | TERTIARY + | RED | Tertiary output = 5 to 6.5VDC* with 8A/42W maximum output. This output is powered at all times when battery is connected to PMU. |
| 6 | TERTIARY - | BLACK | Tertiary Ground Reference |



General Notes:

- Customer responsible for fusing all loads
- Battery recharges from External Input or AC input
- Enclosure type: 3CN Univ - 2CN
- All outputs are filtered to 100Mhz to 1 Ghz and include protection against Reverse Polarity and Transients

*Output voltages are factory adjustable within the range specified. Other voltage options may be available, enquire with engineering

MAINTENANCE

Torque Specifications

Table 2. Torque Specifications

| Description | Torque | Type |
|---|--------------------|-------------|
| Spark Plug | 10 N-m (90 in-lb) | NGK CM-6 |
| Prop Bolts | 7.3 N-m (65 in-lb) | M5 x 70 mm |
| Spinner Bolts | 3.4 N-m (30 in-lb) | M5 x 120 mm |
| Muffler Bolts | 6.8 N-m (60 in-lb) | M5 x 20 mm |
| Throttle Body Mounting Bolts ¹ | 2.3 N-m (20 in-lb) | M5 x 40 mm |
| Cylinder Bolts | 8 N-m (70 in-lb) | M5 x 13 mm |
| Crank Case Bolts | 8 N-m (70 in-lb) | M5 x 20 mm |
| Air Filter Torque | 0.6 N-m (5 in-lb) | HFE0857 |

¹Caution: Care must be taken to not over tighten the throttle body mounting bolts. Over tightening can distort and damage the injected molded reed valve parts, rubber gaskets, and throttle body.

Table 3. Spark Plug Gap

| | |
|-----------------------|---------------------------------------|
| Spark Plug Gap | 0.38mm to 0.5mm (0.018 to 0.020 inch) |
|-----------------------|---------------------------------------|

Maintenance Schedule

Table 4. Maintenance Schedule

| Item | Before Each Flight | Every 50 Hours | Every 100 Hours | Every 300 Hours |
|-------------------------|--------------------|----------------|-----------------|-----------------|
| Engine Oil Pre-Mix | X | | | |
| Spark Plug Check/Adjust | | X | | |
| Spark Plug Replace | | | X | |
| Air Filter Check/Clean | | X | | |
| Air Filter Replace | | | X | |
| Fuel Filter | | X | | |
| HFE OEM Maintenance | | | | X |

Fuel Filter Replacement

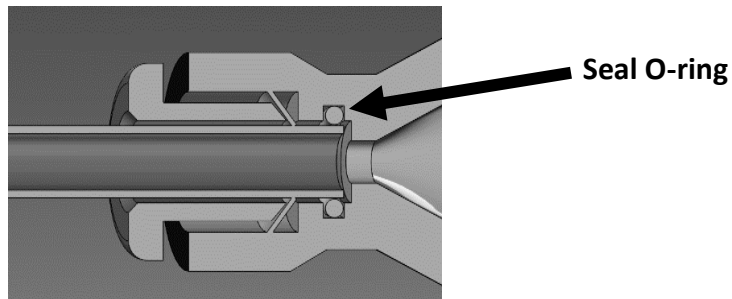


Figure 9. Push-to-Connect Seal

The GenPod® is supplied with 2 filters: One 65 micron filtration element that is green and one 10 micron filtration element that is black. Fuel filters are designed to be installed with a push to connect fitting. When installing the fuel filter make sure the push to connect is pushed all the way down to the seal as shown in **Figure 9**. Also verify that the end of the tube is cut perpendicular and smooth without flashing that may damage the O-ring seal or prevent sealing.

1. Install the green fuel filter between the quick disconnect and the aircraft fuel tank.
2. The blue filter is part of the GenPod® and can be found on the back bulkhead. It resides between the fuel pump and the engine. See **Figure 10** for location



Figure 10: Fuel Filter Location

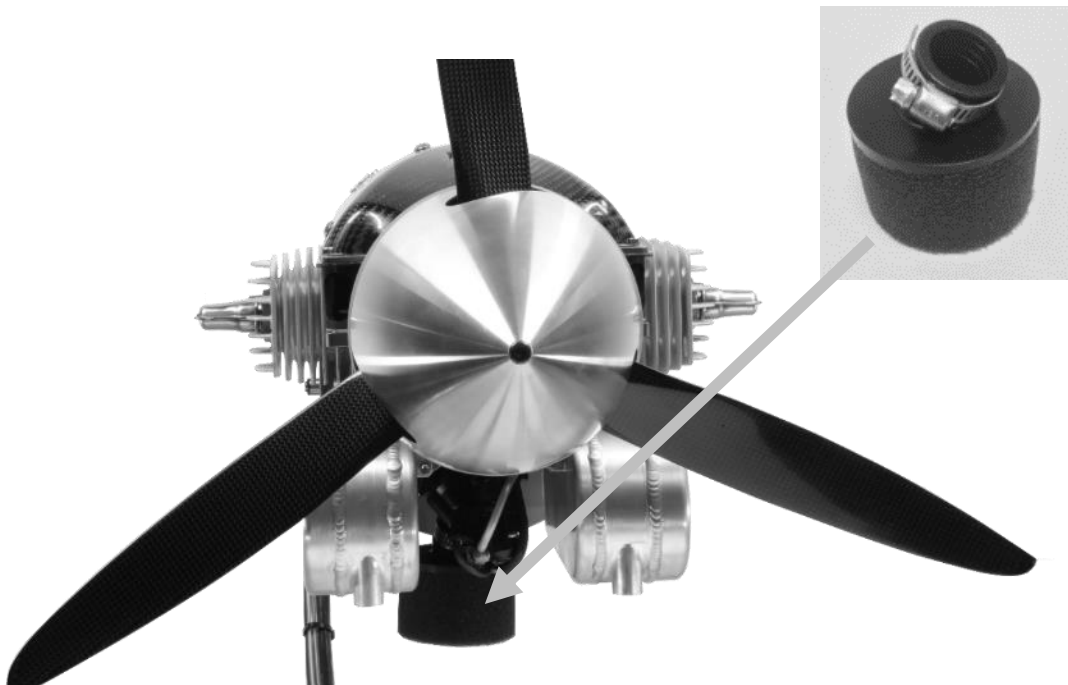
Air Filter Replacement

WARNING: Air filter installation is critical for protecting the throttle body from foreign objects and dust that may jam the throttle barrel. Make sure the air filter is installed at all times!

Replace air filter as needed by unscrewing the hose clamp and pulling the filter off of the throttle body. Re-install the new filter. Do not over-tighten the hose clamp or the rubber may tear. Follow torque specification in **Table 2**.

Only use OEM air filter PN HFE0857.

Make sure to rotate the air filter on the throttle body until it does not contact the muffler surface.



TROUBLESHOOTING

Engine Does Not Start

No spark at spark plug(s)

| Fault | Potential Cause | Corrective Action |
|------------|--|---|
| Power | GenPod® power is not 12 V or does not have enough current capacity when engine is cranking | Repair or diagnose Power Supply. Verify GenPod® connector is fully seated. |
| | Enable signal is not referencing system ground | Tie autopilot ground to GenPod® system ground. |
| | Enable signal is not 5V | Change enable voltage to 5 V |
| Spark Plug | Throttle Position below 5% | Increase throttle position above 5% |
| | Gap not correct | Adjust per Table 3 |
| | Wet Spark Plug Electrodes | Remove plugs and let cylinder and plugs dry. |
| | Carbon Deposit on Electrodes | Replace spark plugs |
| | Insulator failure or cracked insulator | Replace spark plugs |
| Ignition | Burned electrodes | Replace spark plugs |
| | Ignition cap corroded or worn through plating where it contacts spark plug hex. | Return GenPod® to HFE International for repair |
| | Ignition Coil Failure | Return GenPod® to HFE International for repair |
| | Ignition Power | Return GenPod® to HFE International for Repair |

Miss-firing but not starting (spark is working)

| Fault | Potential Cause | Corrective Action |
|--------------------------------|--|--|
| Start Rotation Direction Wrong | Engine is being turned the wrong rotation for starting. (Review the label on the engine for correct prop rotation) | <ol style="list-style-type: none"> 1. If externally started, change manual starter to turn opposite direction. 2. If started with GenPod® alternator, disconnect two of the three phase wires and connect them to the opposing lead. Re-start. |
| Fuel Pressure | Air in fuel lines or fuel lines not connected properly | <ol style="list-style-type: none"> 1. Verify that there is fuel in tank. 2. Remove pod, re-connect fuel lines and follow priming procedure, then re-start. |
| | Over Pressure | Verify that fuel tank is vented and there is no external pressure on the fuel inlet tube. |
| | Kink in fuel line | Remove any kinks in fuel lines |
| Enable | Enable signal is not referencing system ground | Tie autopilot ground to GenPod® system ground. |
| | Enable signal is not 5V | Change enable voltage to 5 V |
| | Throttle Position below 5% | Increase throttle position above 5% |
| Spark Plug | Gap not correct | Adjust per Table 3 |
| | Wet Spark Plug Electrodes | Remove plugs and let cylinder and plugs dry. |
| | Carbon Deposit on Electrodes | Replace spark plugs |
| | Insulator failure or cracked insulator | Replace spark plugs |
| | Burned electrodes | Replace spark plugs |
| No Fuel | Flood Clear Enabled | Reduce throttle position below 35% |

Lack of “full power” and/or unstable running

| Fault | Potential Cause | Corrective Action |
|--|--|--|
| Engine running well but full power is not as high as expected. | Various external causes | See “Power Worksheet” To determine if engine is at max power. |
| Engine cuts out at Wide Open Throttle | Ignition Coil Failure | Return GenPod® to HFE International. |
| | Crank Sensor Fault | Return GenPod® to HFE International. |
| Fuel Pressure | Air in fuel lines or fuel lines not connected properly | 1. Verify that there is fuel in tank. 2. Remove pod, re-connect fuel lines and follow priming procedure, then re-start. |
| | Over Pressure | Verify that fuel tank is vented and there is no external pressure on the fuel inlet tube. |
| | Kink in fuel line | Remove any kinks in fuel lines |
| Enable | Enable signal is not referencing system ground | Tie autopilot ground to GenPod® system ground. |
| | Enable signal is not 5V | Change enable voltage to 5 V |
| Spark Plug | Gap not correct | Adjust per Table 3 |
| | Wet Spark Plug Electrodes | Remove plugs and let cylinder and plugs dry. |
| | Carbon Deposit on Electrodes | Replace spark plugs |
| | Insulator failure or cracked insulator | Replace spark plugs |
| | Burned electrodes | Replace spark plugs |
| Throttle valve not opening | Servo failure or linkage jam | Return GenPod® to HFE International. |
| Fuel | Water in Fuel (if ethanol blend, water can accumulate on the bottom of the tank and cause poor running engine) | Flush fuel tank and re-fill |

MAX POWER WORKSHEET

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Power Available Worksheet

Multiply the following percentages together to acquire the total power loss. Use the graphs provided in this section to determine the CHT, MAT electrical power draw, and altitude corrections below.

Table 5. Power Available Calculator

| CHT % | | MAT % | | Electrical Draw % | | Altitude % | | Total % |
|-------|---|-------|---|-------------------|---|------------|---|---------|
| | X | | X | | X | | = | |

Using RPM to determine power check:

1. Determine total power available by **Table 5**.
2. Determine expected maximum RPM from **Figure 11**

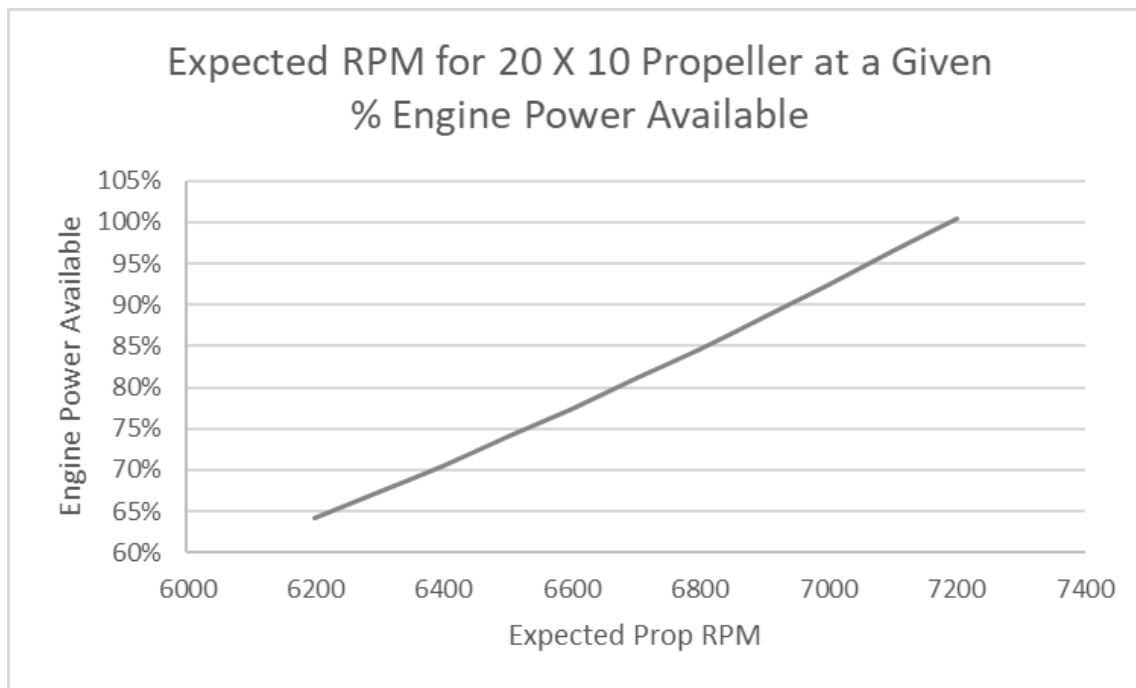
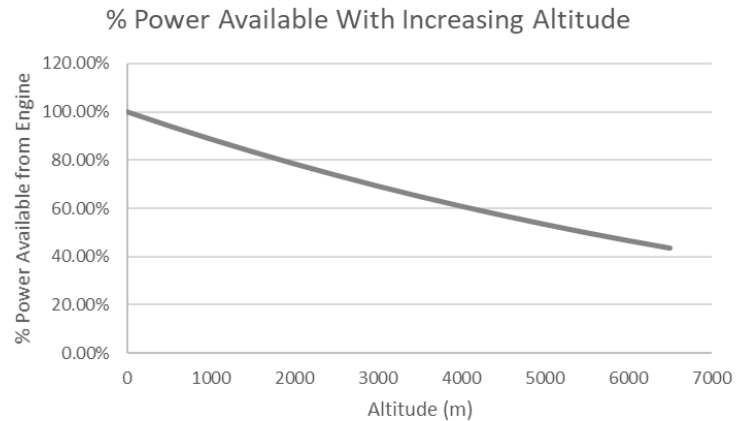
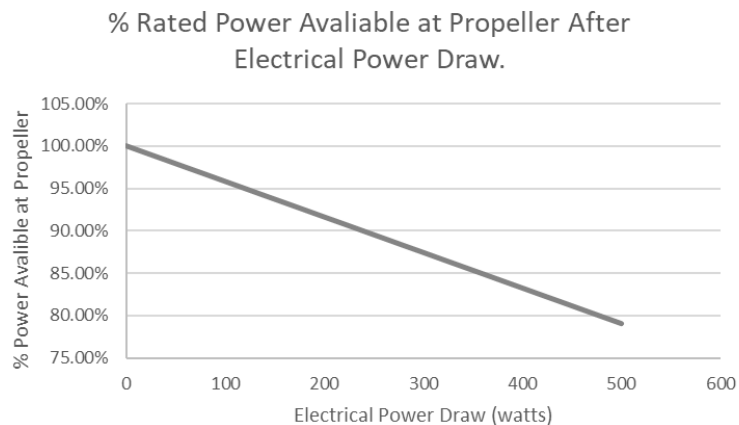


Figure 11. Expected RPM

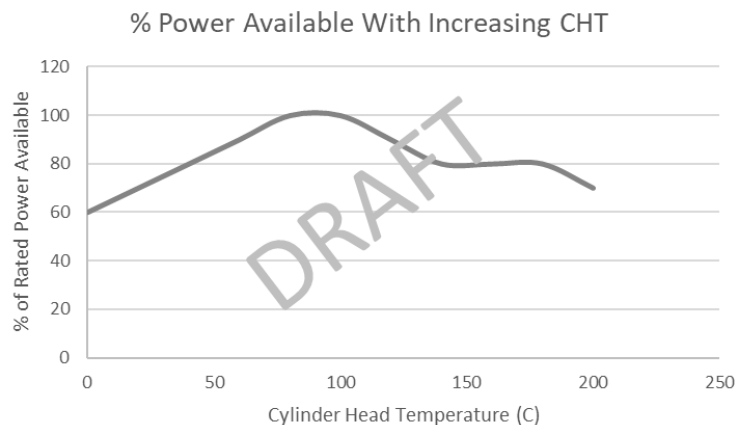
What is the altitude you are at when doing the max power check? Use this chart to determine what the engine can output at various altitudes.



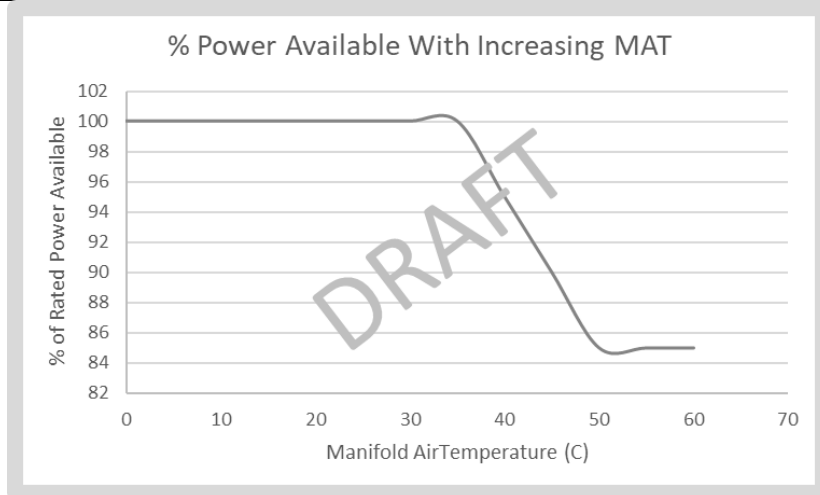
Determine how much electrical power you are drawing from the generator and PMU system when you are doing the max power test. Use this chart to determine what the engine can output after electrical loads are applied.



When the engine is being tested, record the Cylinder Head Temperature value and determine what the engine power output should be from this chart



When the engine is being tested, record the value for Manifold Air Temperature and use it to determine what the engine power output would be from this chart.



PARTS LIST

Coming soon.

WARRANTY

Thank you for choosing an HFE International.

Your Total satisfaction is our #1 priority.

If you have any questions on the installation and operation of this engine, please contact us directly. Please have your GenPod® serial number on hand when calling for service.

HFE International Fuel Injected Engine Customer Service:

Phone: 520.578.0818

Email: contactus@hfeinternational.com

**1646 South Research Loop STE 170
Tucson, Arizona 85710
U.S.A**

Engine Core Warranty

Your DA70 motor and ignition system are covered with a 3 year warranty by Desert Aircraft, starting from the date of purchase.

- **This warranty covers defects in workmanship and materials only.**
- **Do not disassemble the motor or ignition system. Disassembly of the motor or ignition system can void the warranty on that item.**
- **Any modifications to the motor, or the ignition system, other than those authorized by Desert Aircraft, will void this warranty.**

This warranty does not cover the following:

- **Shipping expenses to and from Desert Aircraft for warranty service.**
- **Damage caused by improper handling, operation, or maintenance.**
- **Damage caused by a crash.**
- **Damage caused by using improper fuel or additives.**
- **Damage incurred during transit to Desert Aircraft. WRAP AND PACK ENGINE CAREFULLY!!**

NOTE: DESERT AIRCRAFT WILL NOT SHIP ANY WARRANTY REPLACEMENT ITEMS UNTIL POSSIBLY DEFECTIVE ITEMS IN QUESTION ARE RECEIVED BY DESERT AIRCRAFT.

GenPod® System Warranty

Your GenPod® system is covered with a 1 year warranty by HFE International starting from the date of shipment.

This warranty covers defects in workmanship and materials only to include Fuel Pump, wiring, ECM and throttle body.

Do not disassemble the GenPod® assembly. Disassembly of the GenPod® assembly will void the warranty on that item.

Any modifications to the GenPod® assembly, other than those authorized by HFE International, will void this warranty.

This warranty does not cover the following:

- Shipping expenses to and from HFE International for warranty service.
- Damage caused by improper handling, operation, or maintenance.
- Damage caused by a crash.
- Damage caused by using improper fuel or additives.
- Damage incurred during transit to HFE International.

NOTE: HFE INTERNATIONAL WILL NOT SHIP ANY WARRANTY REPLACEMENT ITEMS UNTIL POSSIBLY DEFECTIVE ITEMS IN QUESTION ARE RECEIVED BY HFE INTERNATIONAL.