



Work Instructions

Model C60 Engine Replacement

Purpose and Scope

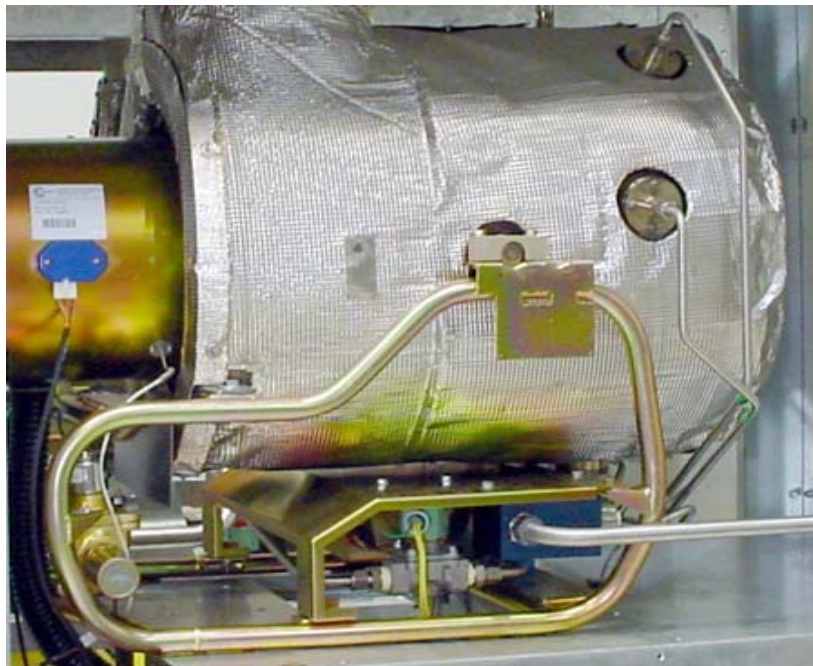
This document provides procedural steps for the removal and installation of a Capstone Turbine Corporation Model C60 engine.

Guidelines

This document presents information sufficient to allow an Authorized Service Provider (ASP) to properly replace the C60 engine. Retain all parts removed for use at installation, unless otherwise specified. Discard parts if noted in this document.

Full engine replacement should only be performed when the failure level has been diagnosed to the entire engine and troubleshooting cannot be localized to simple component part replacement. Contact Capstone Technical Support prior to replacement. Only an ASP should perform C60 engine removal and replacement.

Refer to the Capstone MicroTurbine Standard Warranty (511614) for terms of authorized coverage for Model C60 engine replacement.



Model C60 Engine

Safety Precautions

Only an ASP should open the MicroTurbine and other equipment connected to the MicroTurbine due to the inherent danger of multiple power sources. Observe and adhere to the following Safety Precautions:

- Verify that the inlet fuel supply is shut off.
- Ensure that the MicroTurbine is de-energized from the utility. Isolate and lock out the utility (if applicable).
- Open the Stand Alone battery circuit breaker, lock in the OFF position, and then unplug the battery cable.
- Isolate and lock out any other sources of power to the MicroTurbine. For example, connections to the solid state relays in the MicroTurbine Communications Bay.
- Using a voltmeter, verify that no voltage is present on any electrical terminals.
- Never work on energized equipment.
- Ensure above power sources have been turned off and unit has been de-energized for at least 5 minutes to reduce the risk of electrical shock.
- Observe all safety precautions to prevent possible injury or death.

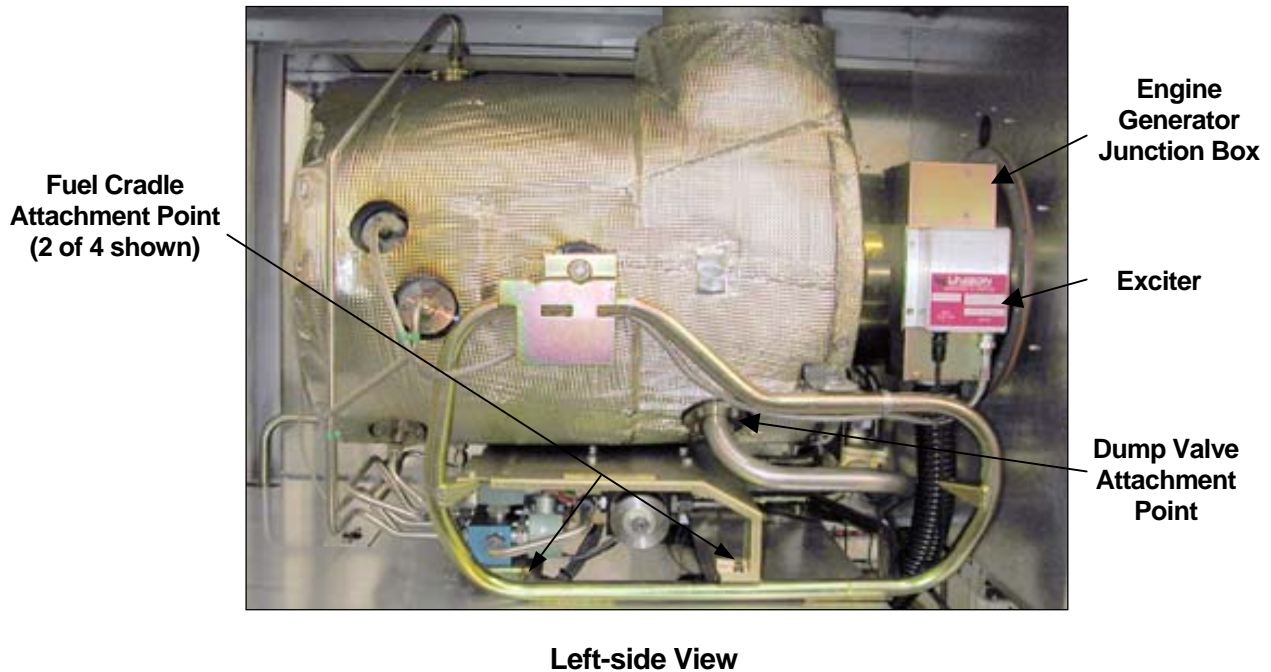
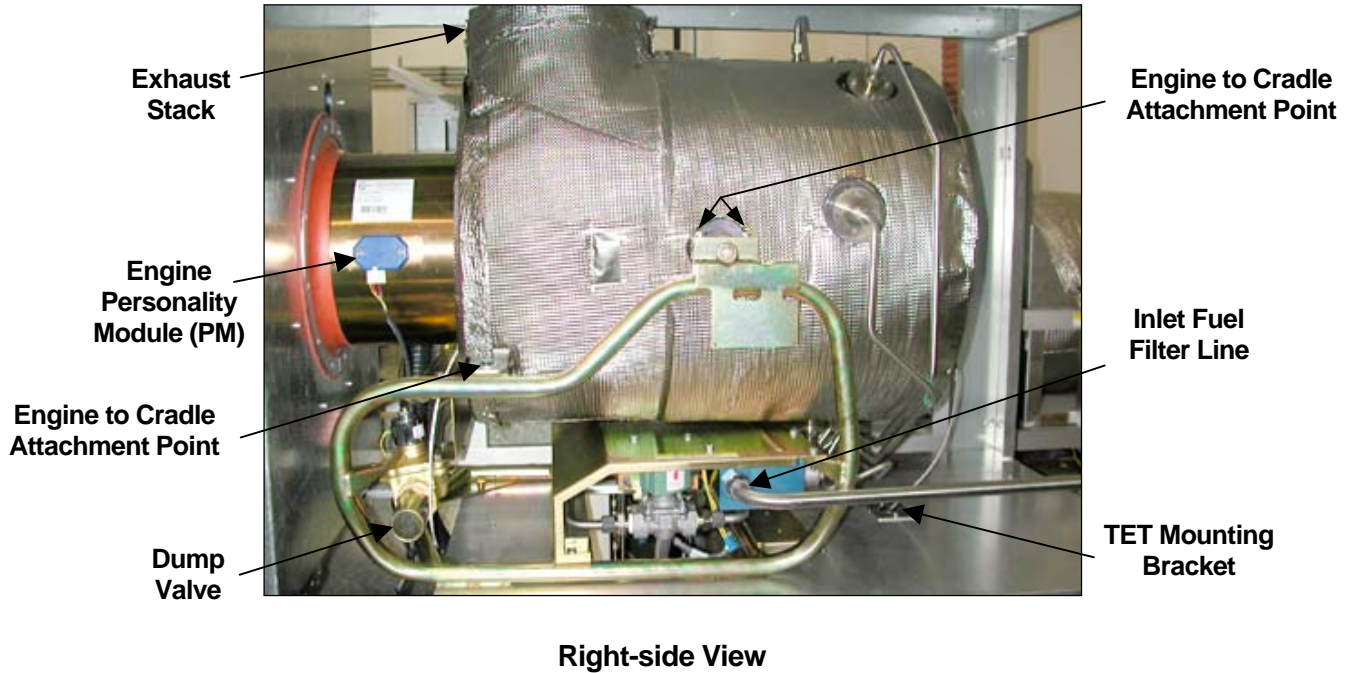
Recommended Tools

The following tools are required to perform procedures listed in this document:

- 11/16-inch wrench
- 9/16-inch wrench or deep socket
- 7/16-inch wrench or deep socket
- 5/16-inch wrench or deep socket
- 1 1/8-inch wrench
- 3/4-inch wrench
- 12 mm wrench and deep socket
- 1/4-inch 12-pt deep socket
- #2 phillips-head screwdriver
- Flat-head screwdriver
- LPS penetrating compound
- Nickel based anti-seize compound
- Torque wrench (0 - 275 inch-lbs adjustable)

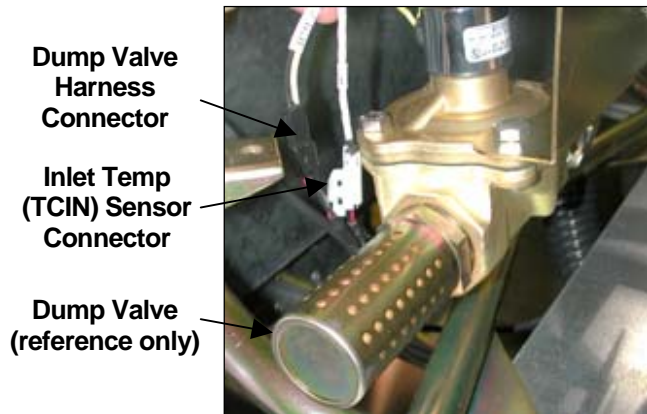
Removal Procedure

WARNING	The engine assembly and fuel cradle weigh 450 pounds. A lifting device, or four people are required to remove the engine from the enclosure.
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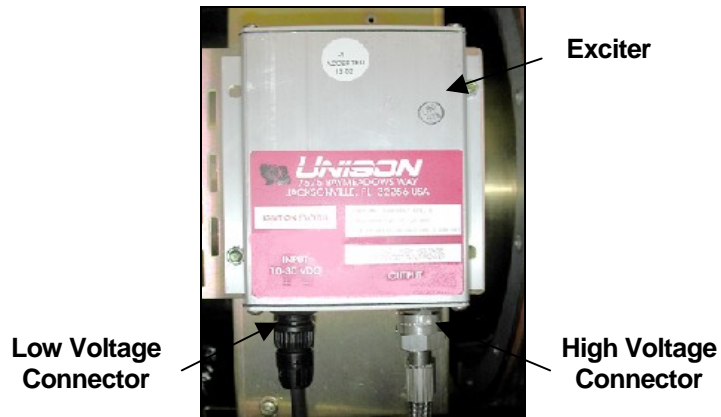


Perform the following steps:

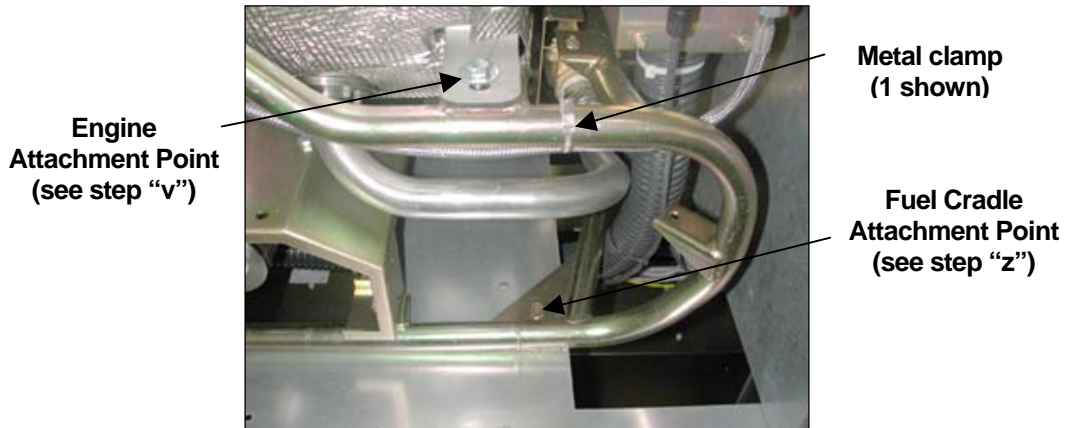
- a. Shut down the MicroTurbine system and allow the engine to cool. It is recommended that the engine cool for several hours to avoid injury.
- b. Open and lock the dedicated disconnect switch to isolate the MicroTurbine from utility grid or loads.
- c. Turn off the battery circuit breaker.
- d. Allow 5 minutes to allow the DC bus to fully discharge.
- e. Shut the natural gas supply off.
- f. Disconnect the connector for the TET thermocouple (yellow cable with DB9 connector).



- g. Disconnect the connector for the inlet temperature (TCIN) sensor.
- h. Disconnect the connector for the engine personality module (PM).
- i. Disconnect the harness connector from the dump valve.
- j. Disconnect the high voltage and low voltage connectors from the exciter (use a 3/4-inch wrench).



- k. Disconnect the metal clamps holding the igniter harness to fuel cradle body.



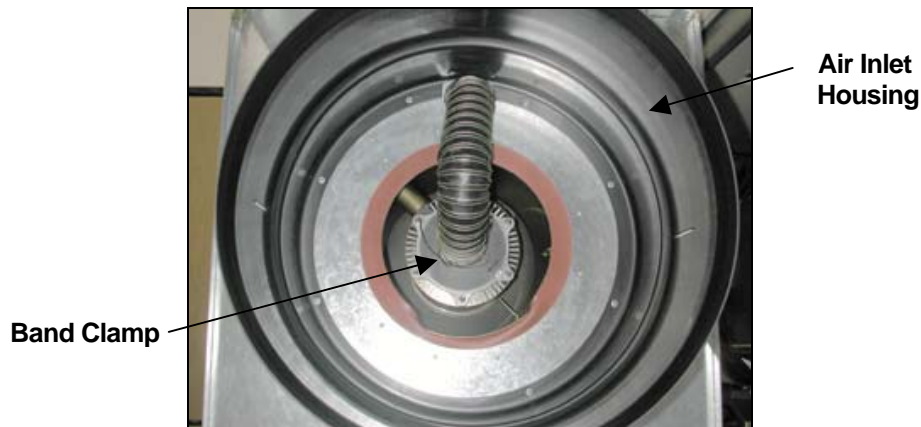
- l. Disconnect the 6 fuel lines from the associated injectors (use 11/16-inch wrench). Loosen fuel lines #1 and 3 at the fuel manifold to enable injector lines to be moved away or removed at the time of engine replacement.

NOTE	Mark the associated injector fuel lines on the manifold with the injector position on the engine for later reconnection at engine installation.
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- m. Remove the air inlet filter from the MicroTurbine housing by pulling gently on the black knob in the center of the filter. Refer to Model C60 Air Filter Replacement Work Instructions (440051) for details.

CAUTION	If the filter does not easily detach from the housing, do not exert more pressure. Using excess force in removing the filter can cause the knob to detach and lead to the air filter unraveling.
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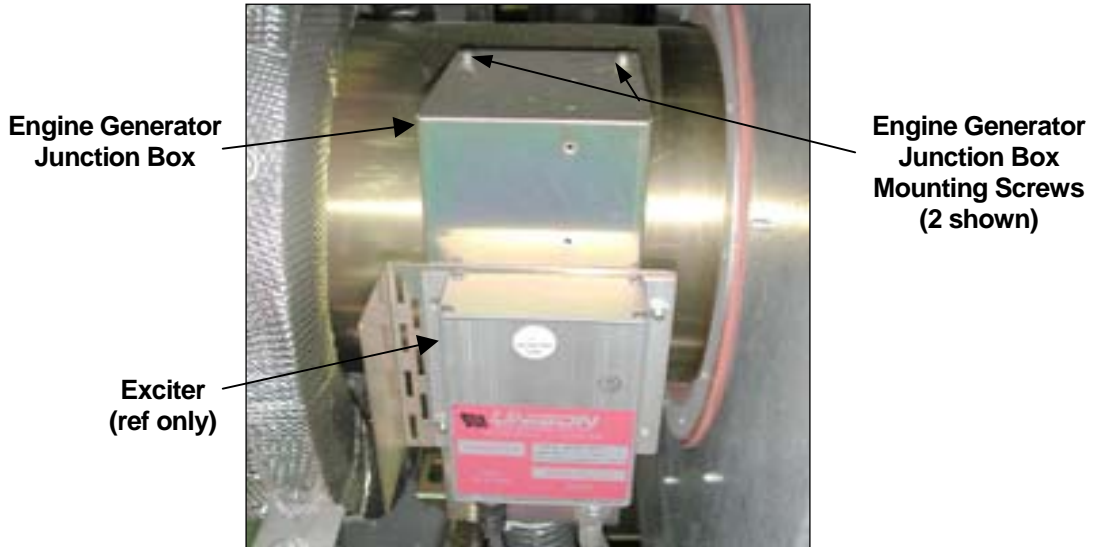
- n. Disconnect the black flex hose from the power head by unscrewing the band clamp with a 5/16-inch deep socket.



- o. Disconnect the dump valve from the engine by unscrewing 4 bolts at the flange connection with the engine using a 12-point, 1/4-inch deep socket. Refer to Dump Valve Replacement Work Instructions (440048) for details.

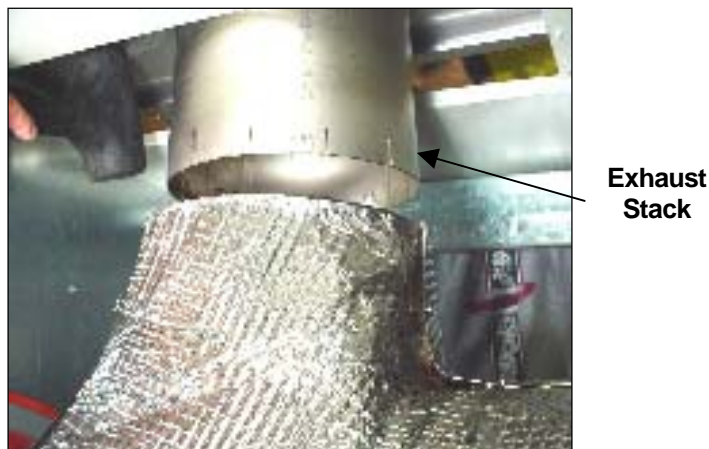
NOTE	Use LPS LST penetrating compound (or equivalent solvent) on the bolts before attempting removal.
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- p. Remove four phillips-head screws from the engine generator junction box.



- q. Open the engine generator junction box cover and remove the 2 phillips-head screws from the bottom of the box.
- r. Disconnect the “Anderson” power connections from the generator leads.
- s. Remove the exhaust stack by applying force to the underside of the roof using a soft rubber mallet. Pull the stack up and out from the engine.

NOTE	Applying excess force in removing the exhaust stack may cause damage to the roof of the MicroTurbine.
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To remove the engine without the fuel cradle:

- t. Unscrew the eyebolts from the roof of the MicroTurbine and remove the roof.



- u. Detach the “U” clamp on both sides of the engine from the fuel cradle using a 7/16-inch deep socket or wrench.

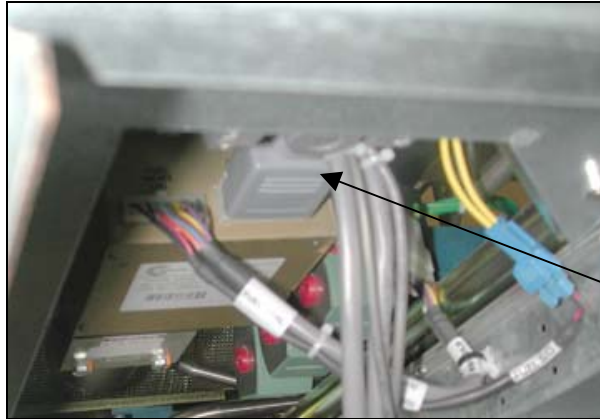


- v. Remove two bolts and two nuts from the engine front right and left base (use a 9/16-inch deep socket or wrench).
- w. Remove the old engine by pulling the engine backward from the engine inlet and then hoisting the engine straight up through the roof opening.

NOTE	Recommended attachment points (3): (1 and 2) – Attach a hook under the two engine rods located below the “U” clamp removed in step “u”. (3) - Place the belt under the inlet flange as close to the engine housing as possible, being careful not to interfere with the TCIN sensor assembly.
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To remove the engine with the fuel cradle:

- x. Disconnect the internal inlet fuel line from the blue inlet fuel filter (use a 1/8-inch open-end wrench).
- y. Disconnect the engine intra-harness from the SPV.



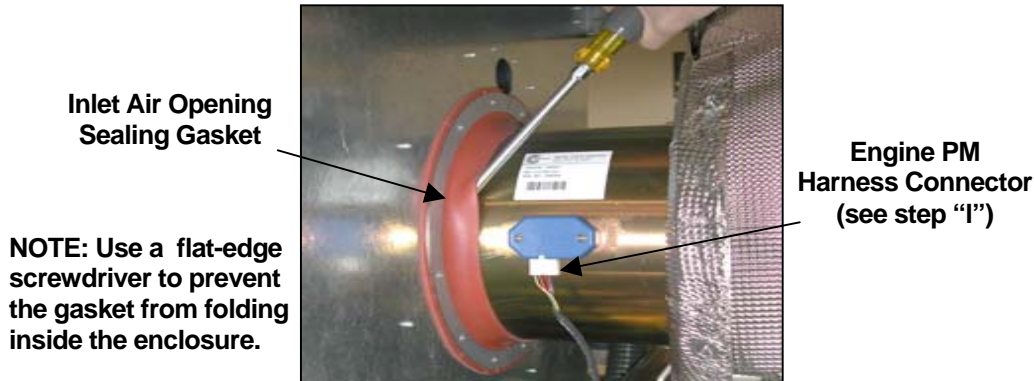
SPV to Intra-harness
Connector (step “y”)

- z. Remove the 4 bolts holding the entire fuel cradle from the frame. Use a 12-mm deep socket.
- aa. Verify that the engine is completely disconnected from attaching harnesses and cables. Then, slide the engine back from the engine inlet and remove the cradle/fuel box (with engine) from the side of the MicroTurbine.

Installation Procedure

- a. Install the new Model C60 engine loosely on the fuel cradle, and gently push the front of the engine through the inlet air opening.

NOTE	Use a long flat-edge screwdriver to prevent the orange sealing gasket from folding inward into the inlet air opening.
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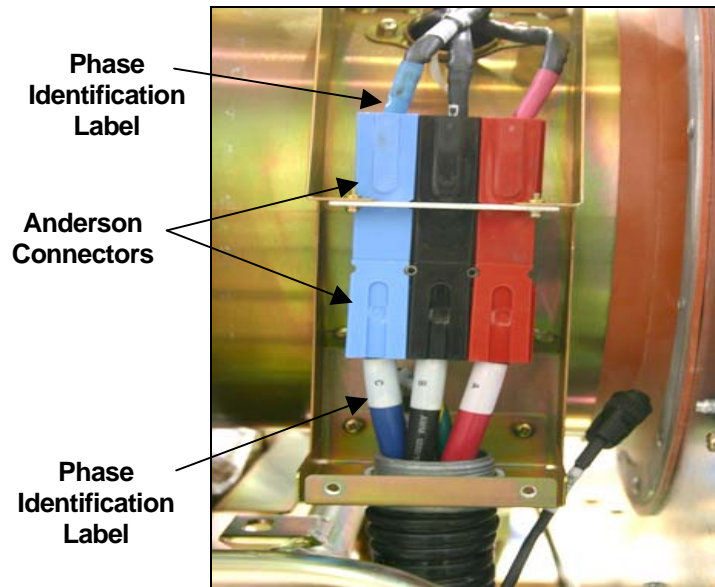
- b. Bolt the "U" clamps on both sides; do not tighten securely.
- c. Bolt the front bases of the engine to the fuel cradle; do not tighten securely.
- d. Apply a nickel-based anti-seize compound to injector bolt threads and install crush washers. Refer to the Model C60 Gaseous Fuel Injector Replacement Work Instructions (440095).
- e. Connect fuel lines to all 6 injectors and torque to 275-inch/lbs.

WARNING	The MicroTurbine will not work properly if the injector and fuel line reconnection order is out of sequence.
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- f. The fuel lines at the fuel manifold should be hand-tightened (plus one and a quarter turn tight).
- g. Connect the inlet fuel line to the blue inlet fuel filter (if disconnected), and hand-tighten (plus one and a quarter turn).
- h. Install the fuel cradle to the frame (if disconnected) using attaching bolts.
- i. Secure the engine to the fuel cradle at the "U" clamps and at the front bases.
- j. Install the dump valve on the engine and secure at the flange connection with the engine using a 12-point, 1/4-inch deep socket. Apply the nickel-based anti-seize compound to the bolt thread before installation. Refer to the Dump Valve Replacement Work Instructions (440048) for details.
- k. Install the TET thermocouple connector to the engine harness.
- l. Install the connector from the inlet temperature sensor to the engine harness.

- m. Install the connector to the engine PM.
- n. Connect the engine intra harness to the SPV (if disconnected).
- o. Connect the ECM power harness (Anderson connectors) to the engine generator junction box.

NOTE	Verify the phase identification labels (A, B, C) on the upper and lower Anderson connectors match each other inside the engine generator junction box. In newer C60 models, the colors should match.
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- p. Tighten the 2 phillips-head screws at the bottom of the junction box.
- q. Attach the cover and secure the junction box using 4 phillips-head screws.
- r. Connect the igniter cable to the exciter box and hand-tighten.
- s. Attach the igniter harness to the fuel cradle body using the metal band clamps.
- t. Connect the low voltage engine harness to the exciter.
- u. Turn on the power.
- v. Turn on the fuel.
- w. Issue the Start command and verify that the system is free of leaks using the fuel detector or by applying soapy water.
- x. Test the system for proper operation.

Notifying Capstone Customer Service

Upon completion of the Model C60 engine installation, notify Capstone Technical Support as follows:

1. Complete a Field Service Report. Include the MicroTurbine serial number and part number located on the nameplate at the rear of the enclosure.
2. In the component replacement section of the Field Service Report, include any upgrade information for the component being installed.
3. Send the completed Field Service Report (via e-mail or fax) to Capstone Technical Support at the address noted below:

Capstone Turbine Corporation

21211 Nordhoff Street • Chatsworth, CA 91311 • USA

Telephone: (818) 734-5300 • Fax: (818) 734-5320

Website: www.microturbine.com

If you have additional questions, please contact:

Capstone Technical Support

Toll Free Telephone: (877) 282-8966

Service Telephone: (818) 407-3600 • Fax: (818) 734-1080

E-mail: service@capstoneturbine.com

Capstone Technical Support (Japan)

Service Telephone: (818) 407-3700 • Fax: (818) 734-1080

E-mail: servicejapan@capstoneturbine.com

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