electroair
ELECTRONIC IGNITION SYSTEMS

EIS-41000
Instructions for Continued Airworthiness

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Revision Log

Revision	Pages Affected	Date of Revision	Description of Revision	Approved by	Date of Approval
00			Skipped		
01		06/07/2011	Initial Release	JR	06/07/2011
02		02/21/2012	Added TCM 4 cylinder models	JR	02/21/2012
03		10/07/2013	Corrected issues from FAA memo dated 08/30/2013 and received 09/30/2013	KP	10/08/2013
04		11/01/2013	Added handling information.	KP	11/04/2013
05		11/25/2013	Corrected issues from AEG follow up email dated 11/22/2013.	KP	11/25/2013
06		11/25/2013	Added information regarding MTH cover orientation to annual inspection.	KP	11/25/2013
07		06/23/2014	ECO 1116-0059		06/24/2014
08	2-12	05/20/2021	SA09966CH-A: Electronic Ignition Timing Software Project	JMS	
09	2-19	12/17/2021	Dual EIS Update	JMS	

1.0 Introduction:

This Instruction for Continued Airworthiness contains the necessary information required for the maintenance of the electronic ignition system (EIS) approved for installation in accordance with STC SA02987CH. Electroair is responsible for this document and any changes to it will be made electronically.

2.0 System Description

For STC SA02987CH, the Electroair EIS-41000 Electronic Ignition System can be used as a single magneto replacement, or with certain limitations, can replace both magnetos. An aircraft equipped with an EIS-41000 and a single magneto or two EIS-41000s will make up the dual ignition system. The EIS-41000 kit consists of the following components: Controller (EA-20000), Coil Pack (EA-2000), Spark Plug Wires (EA-4000), Wire Harness (EA-22000), and Trigger Mechanism (EA-3000(LH)(IC)).

Figure 1: EIS-41000 Kit

The EIS-41000 Electronic Ignition System performs its function by delivering energy generated by the coil pack to each spark plug attached to the system. This high voltage from the coil pack (on the order of 70,000V), creates a high intensity, long duration spark which more effectively ignites a wide range of fuel/air mixtures inside of the cylinder. The EIS-41000 is also able to vary the ignition timing (spark event) during the combustion cycle so as to more closely have the peak pressure as a result of combustion occur at an optimal range for a piston engine. The adjustment of ignition timing is based on MAP inside the engine. The combination of a high energy spark and variable timing, the two principle differences between the EIS-41000 and a magneto, permits more an efficient operation of the engine.

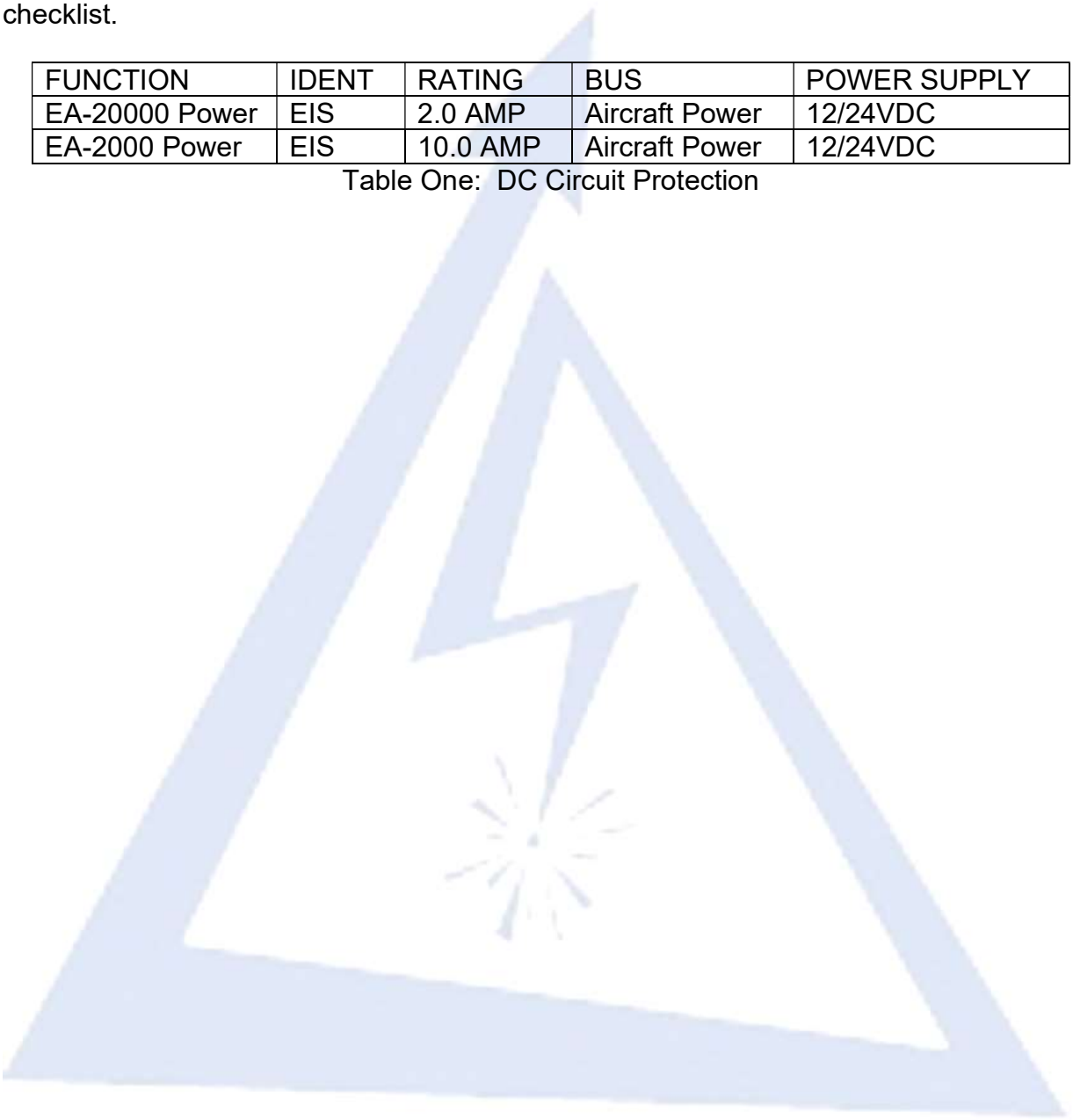
The EIS-41000 is operated by DC power provided by the aircraft's power bus. There are two circuit protection devices used for the EIS-41000; reference table one for the

type and size of the protection devices. These circuit protection devices are not normally accessed during flight.

The EIS-41000 is controlled by using the switch labeled “EIS”. The EIS-41000 may be disabled by setting the switch labeled “EIS” to the OFF position. Pilots should familiarize themselves with the location of the “EIS” before proceeding with the pre-flight checklist.

FUNCTION	IDENT	RATING	BUS	POWER SUPPLY
EA-20000 Power	EIS	2.0 AMP	Aircraft Power	12/24VDC
EA-2000 Power	EIS	10.0 AMP	Aircraft Power	12/24VDC

Table One: DC Circuit Protection



2.1 Dual Electronic Ignition Systems Limitations and Requirements

The electrical power requirements for engines equipped with dual electronic ignition systems will require a separate source of backup electrical power that is independent of the primary source. The separate source of electrical power can take one to the following forms:

- Dual Electrical System: On aircraft with a dual battery or dual alternator/generator systems with independent primary electrical busses, power from each of the electrical busses can be used when the failure of one electrical system is isolated from the other system.
  - **Note:** Twin-engine applications with dual electrical systems may share a common backup power source, independent of either engine's primary power source, which can provide electrical power after loss of power from both independent electrical systems.
- Backup Alternator/Generator System: This system differs from the Dual Electrical System because the backup alternator/generator is not used as a primary source of aircraft electrical power. The backup alternator/generator is used, as an alternate source of electrical power should the primary system fail. These systems are usually attached to either a dedicated or an essential buss and offer reduced current capability when compared to the primary system.

The following must be shown for any backup power supply configuration proposed on any airplane engine installation equipped with a dual EIS.

> (1) If any emergency or other procedure recommends or requires the shutoff of any or all electrical systems in flight, such as for smoke in the cabin or loss of a power generation, then a dedicated backup power source must be provided, which is independent of the primary electrical system and automatically available when any electrical system is shutoff in flight. This applies to both single and dual buss systems on single and multi-engine airplanes.
> (2) For any one engine on a single or multi-engine airplane, it must take at least two independent power source failures for a LOPC event
> (3) For twin-engine airplanes, it must take at least three independent power source failures for a LOPC event in both engines.
> (4) For twin-engine installations, the design must continue to meet the powerplant isolation requirements of §23.903(c), including in at least one configuration, an independent power supply for at least one EIS on each engine.

The minimum requirements for the electrical power system are addressed in 14 CFR 23.1309, 23.1351, 23.1353, 23.1357, 23.1359, 23.1361, 23.1365 and 23.1367. The time required in 14 CFR 23.1353(h) is the minimum time for backup electrical power in the event of a failure of primary aircraft electrical power. The backup power does not need to be wholly dedicated to the electronic ignition system since other critical systems may be supplied by the backup electrical power. However, following the loss of the primary power generation system, a minimum of 60 minutes of backup electrical power for the electronic ignition system is highly recommended. Additionally, the inherent redundancy of an independent power source dedicated to the electronic ignition system is also highly recommended when considering an aircraft electrical power failure.

Please contact Electroair with any questions or clarifications.

3.0 System Operating Information

Under normal operating conditions, the EIS-41000 Electronic Ignition System will be controlled by the flight crew in the same manner as the magneto that was previously installed. The AFM has been updated to reflect the change to the aircraft ignition system. Refer to Operation Manual: AFMS EIS-41000 revision 09 or later FAA approved revision. Installation Manual: IM EIS-41000 revision 14 or later FAA approved revision.

3.1 Placards

Ignition system will be placarded in accordance with installation instructions, identifying the magneto and the EIS. In the case of two or more EISs, placards should differentiate between each EIS.

4.0 Service Information

Refer to aircraft maintenance manual for access and locations of components.
No servicing is required for the EIS-41000 and its components.

5.0 Maintenance Instructions

5.1 Precautionary Statements:

- Read this entire document before starting any processes listed within this document. If there are any questions or concerns please contact Electroair before starting. (248-674-3433 or sales@electroair.net)
- If an EIS is improperly installed, maintained, or misfired; the EIS, the aircraft, the engine, or the installer could be seriously damaged.
- Always use appropriate work and safety practices.
- Spark plug leads shall be disconnected from the ignition system before inspection.
- **DO NOT NEGLECT** the required maintenance of the remaining magneto or pressurize magneto.
- For the latest up to date information refer to www.electroair.net (ICA, AML, Installation Manual, AFMS, etc.)
- For abnormal operation, for ignition systems that have a suspected failure, refer to the Electroair Trouble Shooting Instructions at http://electroair.net/pdfs/troubleshooting_the_EIS.pdf
- For AD notes, service bulletins, or other product notes, review Electroair website (www.electroair.net).
- Refer to the installation manual for required tooling. The installation manual can be found online at http://electroair.net/pdfs/EIS_41000_Installation_Manual.pdf. Note: Installation of the EIS system does NOT eliminate the requirement to comply with applicable airworthiness directives (ADs).
- For ordering or questions about replacement parts, please contact Electroair. (248-674-3433 or sales@electroair.net)

5.2 Scheduled Maintenance

5.2.1 Annually:

1. Inspect all wire connectors. Verify connections are securely attached and free from damage such as chaffing or excessive heat exposure.
2. Inspect all ground connections. Verify they are competent and have continuity with the ground terminal on the aircraft battery or other acceptable ground buss using an ohmmeter.
3. Inspect “Gasket” area on MAG Time Housing/Magneto Plug. Ensure no oil leaks coming from the gasket area. If a new gasket is required contact the factory for replacement part number: EA-001J.
4. Inspect for oil seal failures.
   a. Remove the MTH cover.
   b. Inspect for oil pooling. If oil seal has failed, MTH must be replaced. Note: A thin film of oil does not indicate a failure.
   c. Replace the cover in the same orientation it was removed. For units that have a yellow triangle on the MTH cover label, the yellow triangle shall point towards the magnetic sensor when installed. See Figure 2.

d. NOTE: The MTH is not a field serviceable or repairable unit.

Figure 2: MTH Cover Orientation

5. Inspect all spark plug wires to check for exterior damage such as cuts in silicone, chaffing, evidence of arcing or burn marks. Replace wires if damage is evident. If any wire is suspected of misfiring, verify continuity and resistance values of the wire. Resistance values: Blue Wire (p/n EA-4090) resistance is 350 ohms/ft ±10%. Red Wire (p/n EA-4091) resistance is 5700 ohms/ft ±10%. If wire does not have continuity or is out of resistance value range, replace spark plug wire. Use part number EA-4000REM if using REM spark plugs. Use part number EA-4000RHMRHB if using RHM or RHB spark plugs. Refer to the installation manual, IM EIS-41000, for instructions on how to install spark plug wires.
6. Remove and inspect spark plugs.
   a. Replace if fouled or out of acceptable resistance range. Acceptable resistance range of Electroair sparkplugs should be 5000Ω or less. For non-Electroair spark plugs, refer to the spark plug manufacturer for resistance values.
   b. Verify spark plug gap at this time. For non-Electroair manufactured spark plugs, refer to manufacturers maintenance instructions on how to adjust the gap. Adjust as required.
   c. The gap for the Electroair spark plugs is preset at 0.036 inches. Acceptable range is 0.028-0.038. Gaps larger than the acceptable range should be closed to acceptable range.
7. Inspect all placards and labels for existence and legibility. If missing or no longer readable, replace. Any original placards were created by original install. Refer to Installation manual, IM EIS-41000 Revision 13 or later FAA approved revision, for required placards or labels and follow those instructions if replacements are needed.
8. If fuses were used instead of circuit breakers, inspect for the existence of readily accessible spare fuses. (Note: 14CFR 91.205(c)(6) applies when using fuses.)

5.2.2 Each 1000 hours or five years:
Replace spark plug wires and attaching hardware with new Electroair spark plug wires and attaching hardware. Use part number EA-4000REM if using REM spark plugs. Use part number EA-4000RHMRHB if using RHM or RHB spark plugs. Refer to the installation manual, IM EIS-41000 revision13 or later FAA approved revision, for instructions on how to install spark plug wires.

5.2.3 At Engine Overhaul, at 2500 hours, or Sudden Stoppage:
1. Replace MAG Timing Housing (MTH), if installed, with a new Electroair MTH part number EA-3000(LH)(IC) at 2500 hours after installation or sudden stoppage. Reinstall MTH in accordance with the installation manual: IM EIS-41000 revision13 or later FAA approved revision.

2. Inspect Crank Shaft Trigger Wheel (CSTW), if installed, and brackets.
   a. Replace magnetic sensor, part number: EA-9070.
   b. Inspect brackets for any damage (bending or cracking). Replace damaged brackets.
   c. Remove crank trigger wheel and inspect for damage (bending or cracking). Replace if damaged. Reinstall CSTW assembly in accordance with the installation manual: IM EIS-41000 revision13 or later FAA approved revision.

5.3 Installation and Removal Instructions

1. For removal follow the EIS-41000 Installation Manual in reverse order.
2. For instructions on reinstalling individual EIS-41000 components or the entire system, refer to the EIS-41000 Installation Manual that was included with the EIS 41000 kit. If the original installation manual is not with the system, contact the factory for an up to date replacement installation manual (248-674-3433 or sales@electroair.net) or retrieve from the factory's website www.electroair.net.
3. After re-installation, to verify the operation of the EIS system, perform a normal start and ignition check per aircraft's Pilot Operating Handbook (POH) and AFMS EIS-41000 revision 09 or later FAA approved revision.

5.4 Trouble-shooting

If experiencing abnormal conditions not listed in this section or these troubleshooting instructions do not solve the issue, contact Electroair for assistance.

5.4.1 Specification Checks

These specification checks are not required to be performed on a periodic basis. They are provided here for reference in the event that the EIS is malfunctioning.

1. **Magnetic Sensor Resistance Check**: Electroair has two types of magnetic sensors. Both function in the same way and have three wires, but have different resistance values. Resistance is checked across two of the three wires at the connector. The sensor has either a red, black, and bare wire, or a white, black, and bare wire.
   - Measured resistance across the red and black wires should be between 600-800 Ohms.
   - Measured resistance across the white and black wires should be between 900-1100 Ohms.
2. **Gap between magnetic sensor and trigger wheel check**: A feeler gauge can be used to check the gap between the magnetic sensor and the trigger wheel on the MTH or CSTW.
   - MTH Gap: 0.008-0.015". Set at 0.011" at factory.
   - CSTW Gap: 0.024"
3. **Coil Pack Resistance Check:** Resistance of coils on the EA-2000 or EA-8000 should be between 10k-12k ohms. To check resistance, measure from tower to tower across the same coil. Tower 1 to Tower 2 and Tower 3 to Tower 4 for the EA-2000. Tower A to A, B to B, and C to C for the EA-8000.
4. **Spark Plug Wire Resistance Check:** Spark plug wire resistance is measured from end to end. Boot terminal to boot terminal, or boot terminal to spring end.
   - Blue Wire (part # EA-4090): 350 ohms per foot (+/- 10%)
   - Red Wire (part # EA-4091): 5700 ohms per foot (+/- 10%)

5. **Spark Plug Gap Check:** The gap for the Electroair spark plugs is preset at 0.036 inches. Acceptable range is 0.028-0.038. Gaps larger than the acceptable range should be closed to acceptable range.

5.4.2 Higher than Normal RPM drops during Ignition Check

1. Perform an ignition check and note the RPM drops. If magneto has higher than normal RPM drop, service the magneto. If EIS has higher than normal RPM drop, proceed to step 2.
2. If engine is running poorly or rough, proceed to Section 5.4.3 “Engine runs poorly or rough”. If engine is not running poorly or rough, proceed to step 3.
3. Check Cylinder Head Temperatures (CHTs). If any CHT is high, proceed to Section 5.4.4 “High CHTs”.
4. Perform and induction leak check. If there is a leak, repair the leak and then verify if the RPM drop problem has been fixed. If there is no leak or the RPM drop has not been fixed, proceed to step 5.
5. Inspect MTH for oil seal failure or other damage.
    a. Remove the MTH cover.
    b. Inspect for oil pooling. If oil seal has failed, MTH must be replaced. Note: A thin film of oil does not indicate a failure.
    c. Inspect tamper paint and trigger wheel. If tamper paint has been disturbed or trigger wheel has been loosened from the screws and shaft, MTH must be replaced.
    d. Replace the cover in the same orientation it was removed. For units that have a yellow triangle on the MTH cover label, the yellow triangle shall point towards the magnetic sensor when installed. See Figure 2.
    e. NOTE: The MTH is not a field serviceable or repairable unit.
6. Check the gap between magnetic sensor and trigger wheel. Make sure the sensor is held firmly in place by the set screws. Verify that the trigger wheel has not struck the sensor. If the trigger wheel has struck the sensor, then the sensor needs to be replaced.
7. Verify the correct installation of the MTH or CSTW. The trailing edge of the 11th tooth after the two missing teeth on the trigger wheel needs to be centered under the sensor with the engine at TDC cylinder #1. Correct as necessary, then verify RPM drop has been fixed. See Figure 3 for tooth alignment.

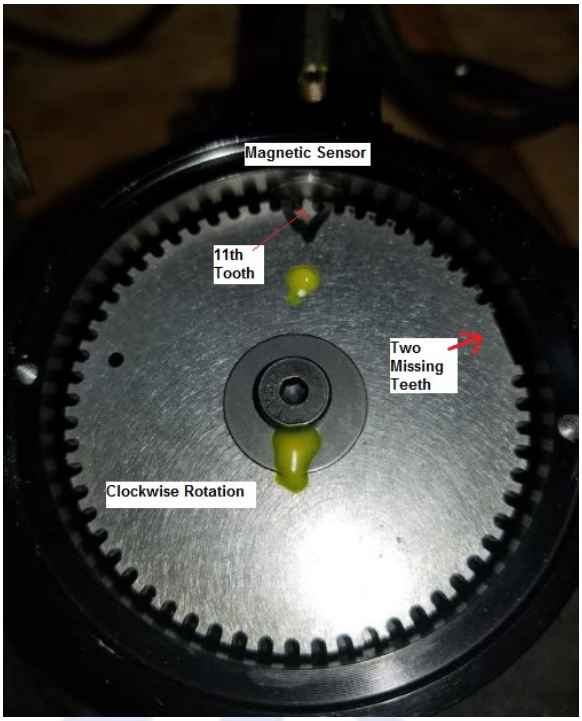


Figure 3: Four Cylinder MTH Trigger Wheel Positioning for TDC

5.4.3 Engine runs poorly or rough

1. Verify all ground connections are competent and have continuity with the ground terminal on the aircraft battery or other acceptable ground buss using an ohmmeter.
2. Verify that spark plug wires are set to correct firing order and securely connected at the coil tower and spark plug.
3. Inspect all spark plug harness for evidence of arcing or arc-out (indicated by small burn marks near the spark plug/spring); round black marks on spark plug wire near attaching hardware. Repair or replace as necessary.
4. Inspect all spark plugs for proper gap, cracked ceramic, cleanliness, wear and resistance. Resistance values should be 5k ohms or less. Repair or replace as necessary.
5. Verify placarded timing on controller matches engine placarded timing.
6. Record RPM rise on shutdown. Verify that this meets engine requirements. If it doesn't meet the engine requirements, follow the steps from the engine manufacture instructions to fix the problem.
7. If one or more cylinders can be identified as dropping off, swap wires at coil towers. If problem remains with suspect cylinder, inspect and repair plug or wire as necessary. If problem moves to a different cylinder, replace the coil pack.

5.4.4 High CHTs

1. Verify placarded timing on controller matches engine placarded timing.
2. Verify the correct fuel is being used and verify the fuel system is working correctly.

3. Perform and induction leak check. If there is a leak, repair the leak and then verify if the problem has been fixed. If there is no leak or the problem has not been fixed, proceed to step 4.
4. Inspect the MTH for oil seal failure or other damage.
    a. Remove the MTH cover.
    b. Inspect for oil pooling. If oil seal has failed, MTH must be replaced. Note: A thin film of oil does not indicate a failure.
    c. Inspect tamper paint and trigger wheel. If tamper paint has been disturbed or trigger wheel has been loosened from the screws and shaft, MTH must be replaced.
    d. Replace the cover in the same orientation it was removed. For units that have a yellow triangle on the MTH cover label, the yellow triangle shall point towards the magnetic sensor when installed. See Figure 2.
    e. NOTE: The MTH is not a field serviceable or repairable unit.
5. Check the gap between magnetic sensor and trigger wheel. Make sure the sensor is held firmly in place by the set screws. Verify that the trigger wheel has not struck the sensor. If the trigger wheel has struck the sensor, then the sensor needs to be replaced.
6. Verify the correct installation of the MTH or CSTW. The trailing edge of the 11th tooth after the two missing teeth on the trigger wheel needs to be centered under the sensor with the engine at TDC cylinder #1. Correct as necessary. See Figure 3 for tooth alignment.

5.4.5 Hard Starting and/or Engine Kick-Back during starting

1. Verify all ground connections are competent and have continuity with the ground terminal on the aircraft battery or other acceptable ground buss using an ohmmeter.
2. Check for a weak battery.
3. Check for bad/worn/small gauge starter cables.
4. Verify that the RPM is above 60RPM during starting.
5. Verify the correct installation of the MTH or CSTW. The trailing edge of the 11th tooth after the two missing teeth on the trigger wheel needs to be centered under the sensor with the engine at TDC cylinder #1. Correct as necessary. See Figure 3 for tooth alignment.
6. Verify placarded timing on controller matches engine placarded timing.
7. Verify that fuel system is working correctly.

5.4.6 Engine runs poorly or rough at high RPM and/or high engine load

This indicates possible failure of either a spark plug or spark plug wire.

1. Inspect all spark plug harness for evidence of arcing or arc-out (indicated by small burn marks near the spark plug/spring); round black marks on spark plug wire near attaching hardware.

2. Inspect all spark plugs for proper gap, cracked ceramic, cleanliness, wear and resistance. Resistance values should be 5k ohms or less. Repair or replace wires and/or spark plugs as necessary.

5.4.7 EIS dropping off-line or is intermittent.

1. Perform a Magnetic Sensor Resistance Check. See section 5.4.1. Replace sensor if resistance is outside of the specified range.
2. Inspect the power supply to the controller. Check voltage at Pin 6 on the C1 connector in the EA-22000(T) wire harness. Voltage needs to be at least 10 volts for EIS to run.
3. Inspect the power supply to the coil pack. Check voltage at Pin 4 on the C2 connector in the EA-22000(T) wire harness (See Figure 4). Voltage needs to be at least 10 volts for EIS to run.

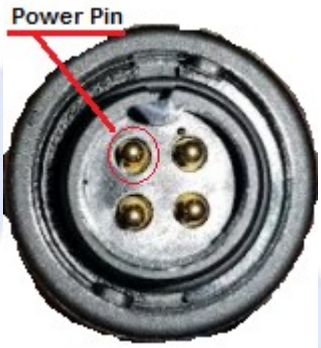


Figure 4: Power Pin of Coil Pack Connector (C2)

5.4.8 EIS will not start

1. With power on to the system, check the LED on the EA-20000 controller. If the LED is not on, then the system is not receiving power. Inspect wiring for bad connections or damage. Repair as necessary.
2. Check to see is controller and coil pack are receiving enough voltage. Voltage needs to be at least 10 volts during the starting sequence for the EIS to run.
3. Verify that the RPM during starting is at least 60 RPMs. The EIS needs to be able to read 2 consistent rotations of the engine above 60 RPM before it starts.
4. Perform a Magnetic Sensor Resistance Check. See section 5.4.1. Replace sensor if resistance is outside of the specified range.

5.5 Special Inspection

Lightning Strikes, Engine Fires, Water Immersion

1. Inspect the EIS wiring harnesses, controllers, and coil packs.
2. If there is obvious damage, replace the damaged parts.
3. If there is no obvious damage, perform a ground run-up. If no problems are found, continue with the standard procedures as stated in the AFMS.
4. If unsure, contact factory (248-674-3433 or sales@electroair.net)

6.0 Receiving and Acceptance Checking of EIS Kit

1. Review the packaging before acceptance from the freight carrier. If the packaging is damaged, refuse the shipment.
2. Open the package; and, review the contents of the package to the content listing on the package. Components of the EIS kit are inserted into different sections and each component should be handled with care.
3. Are all of the materials there?
   a. Yes, proceed to step 4.
   b. No, contact the factory. Have the serial number of the kit available when contacting. (248-674-3433 or sales@electroair.com)
4. Review the controller for damage to the aluminum housing.
5. Review the wires for nicks and cracks.
6. Review the coil pack and plate for external damage.
7. Review the CSTW/MTH for external damage.
8. Are all materials acceptable?
   a. Yes, proceed with installation.
   b. No, contact the factory. Have the serial number of the kit available when contacting. (248-674-3433 or sales@electroair.com)

If possible, store parts in original packaging when not in use. If not possible, wrap parts in cushioning material and place in one location. Review as above prior to reinstallation.

7.0 Eligibility:

Make:	Lycoming	Continental
Model:	235 4-cylinder series	65 4-cylinder series
	290 4-cylinder series	75 4-cylinder series
	320 4-cylinder series	80 4-cylinder series
	360 4-cylinder series	85 4-cylinder series
	390 4-cylinder series	90 4-cylinder series
		200 4-cylinder series
		240 4-cylinder series

(See STC#02987CH Approved Model List (AML) for exact model numbers)

8.0 Manual Reference:

Electroair Kit Part Number	Installation Manual Number
EIS-41000	IM EIS-41000
EIS-41000T	IM EIS-41000
EIS-41000IC	IM EIS-41000
EIS-41000TLH	IM EIS-41000
EIS-41000TIC	IM EIS-41000
EIS-41000TLHIC	IM EIS-41000

(See STC#02987CH Approved Model List (AML) for kit part number applicability)

9.0 Airworthiness Limitations Section (ALS):

Airworthiness Limitations section is FAA approved and specifies maintenance required under 14 CFR §§43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

For Dual Electronic Ignition System installation:
"Dual Electronic Ignition System Installation is eligible for these airplane models that have converted to Dual Split buss electrical systems or dual alternator system by FAA Approved means as applicable.

For aircraft with a dual, or back-up alternator, one EIS shall be attached directly to the back-up alternator. The load attached to each alternator shall not exceed 80% of the total capacity for the alternator, and may need to be adjusted to allow for supplying power to one of the Electroair Electronic Ignition Systems (when dual Electroair systems are installed). Refer to the appropriate Electroair Installation Manual for your kit to receive additional, detailed information."

Revision	Date of Revision	Description of Revision	FAA Approved by	Date of FAA Approval
00		Skipped		
01	06/07/2011	Initial Release		06/07/2011
07	06/23/2014	ECO 1116-0059	Chicago ACO	3/9/2015
09.01	03/31/2022	ALS Update		

FAA Approved: _____ Date:_____

10.0 Glossary and Abbreviations:

- AD(s) – airworthiness directive(s)
- AFM – aircraft flight manual
- AFMS – aircraft flight manual supplement
- ALS – aircraft limitations section
- AML – approved model list
- BTDC – before top dead center
- CFR – code of federal regulations
- CHT – Cylinder Head Temperature
- CSTW – crankshaft trigger wheel
- EIS – electronic ignition system
- FAA – federal aviation administration
- LOPC – Loss Of Power Control
- MAG -- magneto
- MAP – manifold absolute pressure
- May/Should – an optional requirement
- MTH – mag timing housing
- MEL – Minimum Equipment List
- Must/Shall – a mandatory requirement
- POH – Pilot Operating Handbook
- RPM – revolutions per minute
- STC – supplemental type certificate
- TDC – top dead center