CUB CADET ENGINES

Date:	March 17, 2021
Service Subject:	EGOV Engine Start up Operation
Models Affected:	**AX90**
Factory Models Affected:	**XT1-LT42** (13A6A9CS010), (13A6A9CS056), (13A6A9CS210)
Serial Number Range Affected:	All Model Years
Tech Issue:	**Understanding Intellipower Operation As it Relates to Starting**

NOTE: These materials are prepared for use by trained technicians who are experienced in the service and repair of equipment of the kind described in this publication, and are not intended for use by untrained or inexperienced individuals. Such individuals should seek the assistance of an authorized service technician or dealer.
NOTE: Always wear eye protection while servicing equipment. Wear hearing protection when appropriate. Always work in a well ventilated area and follow all safety precautions when dealing with combustible materials.
NOTE: Left (LH) and Right (RH) sides are determined from the operator's position and facing in the forward direction.

Summary:
The procedure for properly starting the Intellipower/EGOV Engines is below. Additional pages will reinforce the LMS Training Module provided in 2019.
Lets Get right to it.

Picture this:
Operator sits on his tractor.
Turns the Key on;
Stop, ***Count with me:***

1

2

Turn key to start position.
What did we get?
Perfect Start each time.

Key Points and Features

- Structure and Design of the IntelliPower feature differs from a standard Carburetor because there are two Stepper Motors inside the Carburetor. Intellipower Carburetor contains one Stepper Motor for the Choke and one for the Throttle Shaft.
- The Choke Stepper Motor will always move to the closed position when the ECM is powered to sync then motion to the best place to stop for starting the engine based off of engine temperature. This motion is complete in about 2 seconds and why waiting to start will give the best results.
- When Engine temperatures are *not* close to -4 F (-20 C) the choke will *not* be fully closed. This is normal to not be fully closed at cold starts with warmer ambient temps.
- *Let's look at this scenario: Customer calls and says "The engine will crank long and start with a little black smoke OR it does not start on the first attempt, but does start up on the 2nd attempt, is something wrong?" We call this an IKS "Instant Key-Start" which is OK, but with this technology it is not the ideal way to start the engine. The IKS causes the engine cranking to occur during the choke sync process which means, the choke has to fully close before going to the ideal position per the temp sensor reading. So there is potentially more fuel added during the 2 seconds of initial cranking compared to waiting for the process to complete. If the engine does not start on the first crank cycle and the key is released but not fully turned off, the 2nd attempt will not cycle the choke giving in most cases a successful start. Allowing time for the choke to cycle during the initial key-on will eliminate the above condition and set the choke to the proper position before the engine starts to crank resulting in the ideal start-up.*

Tech Procedure:

1. **Diagnose.**
- Listen to the customers complaint.
- Become familiar with the Start Procedure
- Re-read the LMS Key Points on pages 2-7.

2. **Determine.**
- Is there a failed component.
- Test components
- **NOTE:** ***See final page for a Kohler Test tool suitable for our Stepper motor testing***

3. **Review**
- Review the following few pages which will give key points on the design and operation of the EGOV.
- Log onto Salesforce and review the LMS Module for EGOV which will include electrical diagrams for both Walk-Behind and Riders.

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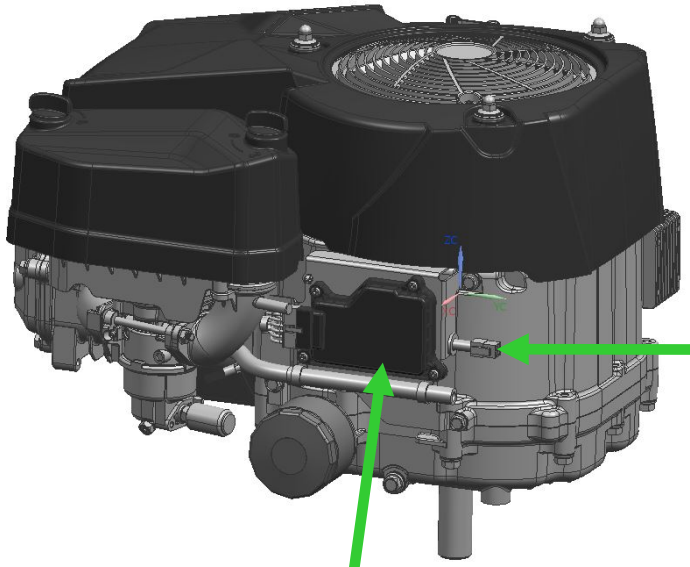
SERVICE MANAGER	PARTS MANAGER	SALES MANAGER	SERVICE TECH	SERVICE TECH

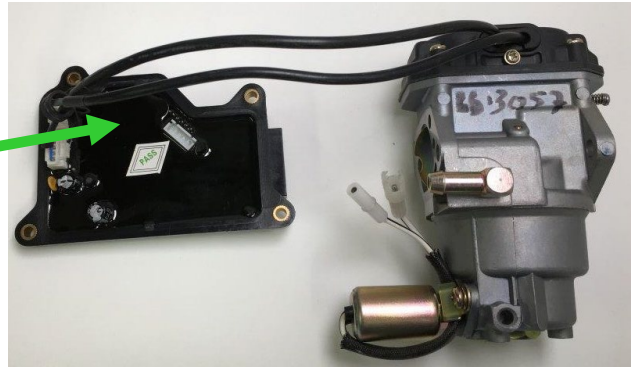
Circulate and Initial

547cc E-Gov Engine



Electronic Governor
Dash Mounted Speed
Selector Connector

E-Gov Module



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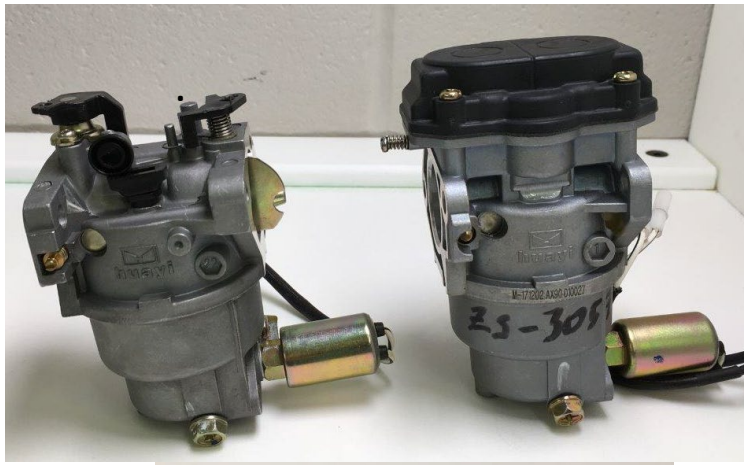
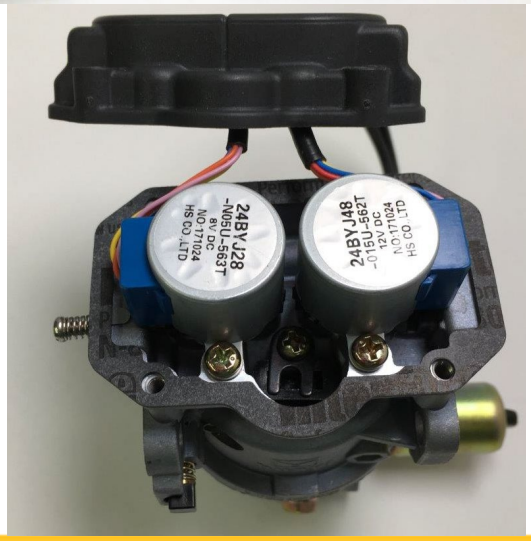
What is E-GOV??

- Mechanical Governor is replaced with stepper motor/s mounted directly to the carburetor.
- Engine mounted E-Governor Module controls the stepper motor function.
- 547cc 2 stepper motors giving it an electronic choke feature which is engine temperature dependent
- 159cc has one stepper motor for throttle and a traditional mechanical auto choke
- Operator throttle control is voltage based – 5v reference
  - Ride-on mowers use a potentiometer to change speeds
  - Push mower units have a two position switch

Electronic vs. Mechanical Governed Carburetors

- The bottom half of E-gov carbs are basically the same as the standard carb for the same engine.
- For E-gov, stepper motors were added to existing carb design then captured in the carburetor casting to seal against debris
- Main carburetor components, including the main jet, pilot jet, air bleeds, etc. are all located in same general location and cleaned / repaired as usual.





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Stepper Motor

- A stepper motor is known for its ability to convert a stream of input pulses, into precisely defined increments in the shaft's position.
- The pulses are typically pulse width modulated, square wave pulses
- Each pulse rotates the shaft a fixed number of degrees.

Diagnostics

- **#1 item to remember -- this is a <u>Carburetor</u>**
  - Surging is most likely due to a lean condition and not a ECM, program, stepper motor, or speed controller issue.
  - No start conditions should be reviewed for fuel/spark just as a normal carburetor.
  - If engine runs ONLY at low idle, then there is an issue at the speed selector or connector. Check and wiggle connector first then check the voltage and switch.

Diagnostics

Situation	Expected result	Notes
Operator shuts down engine	Engine shuts down, E-system goes to sleep in ~5s	
Operator starts engine	Engine should start and remain at 2,500RPM then switch to speed controller setting RPM within 5S	Riders have a thermocouple that may hold 2,500rpm longer than 5s if E-Gov module reports cylinder head temp too cold to increase speed
Engine reaches 4,000rpm	Engine mush shut down (magneto grounded) automatically in 3s	Emergency shutdown feature, E-Gov module leaves magneto line UN-Grounded in all other cases
E-GOV module loses power	Throttle and E-choke will remain in last position	Similar instance to a stuck mechanical governor system
Speed selector unplugged or an open circuit	Engine will remain at lowest idle speed.	2,000rpm on rider, 2,200rpm walk behind
Speed selector sends full 5V signal all the time	Engine will remain at Max Allowable Engine speed	3,200rpm on push, 3400rpm on rider products this year

Stepper Motor Testing

- The stepper motor can be tested by using adapter kit 725-13066 and Kohler stepper motor tester 25-455-21-S
- The Kohler stepper motor tester can be purchased from any Kohler distributor.
- When using the Kohler tester, the 30-70% range will cover 100% of the travel or the MTD stepper motors.