



# APPLICATION INSTALLATION for NT or KT CUMMINS ENGINES with PT PUMP AND EFC FUEL SYSTEM or PT PUMP with MECHANICAL / HYDRAULIC GOVERNOR

**NOTE: ALL COMPONENTS SPECIFIED IN THIS APPLICATION NOTE ARE SOLD SEPARATELY**

**CUSTOMER / OEM:**

**CUMMINS**

**APPLICATIONS:**

Diesel Engine Generators, Compressors, Marine, others

**ENGINE MAKE, MODEL,**

Cummins NT and KT Series engines with Pressure Time (PT) pump and EFC actuator system or with a mechanical / hydraulic governor.

**DISPLACEMENT:**

**FUEL SYSTEM:**

PT pump (mechanical governor) or PT pump and Electronic Fuel Control (EFC) with either normally closed (NC) or normally open (NO) integrated actuator.

**OPERATING SPEED(S):**

Full RPM range

**BATTERY VOLTAGE:**

12 or 24 V DC

**INSTALLED PRODUCTS:**

**ACTUATOR:**

- ADB120E4-GAC (PT pump with EFC)
  - Optional mounting bracket for ADB120E4-GAC: BK114
  - Optional wiring harness for ADB120E4-GAC: CH1203
  - Installation kit KT683 for modifying NORMALLY CLOSED EFC actuator with ADB120E4-GAC installation
- ADC225JS-12/24 (mechanical or hydraulic governor).
  - Optional mounting bracket for ADC225JS-12/24: BK267
  - Optional throttle linkage components for mechanical governor systems:
    - Bearing Rod Ends: BR200 (1/4"-28 thread), BR300 (M5 thread), BR400 (M6 thread).
    - Threaded Rod: RD102- Zinc coated 1/4"-28 thread precut to 1.0 ft (0.3 m). RD233- Zinc coated M6 thread precut to 8.75 in. (222 mm)

**SPEED CONTROLLER:**

- Options:
  - ADB120E4-GAC: ESD5500E or EEG6500
  - EFC (normally closed): EEG6500, ESD5522E, ESD5120
  - EFC (normally open): ESD5119, ESD5160
  - Mechanical Governor - EEG6500, EDG6000, ESD2210, ESD5111, ESD5500E, ESD5500-II, ESD5550

## SUMMARY

The EFC system controls fuel delivery by metering the amount of fuel fed to the mechanical units' injectors through a common distribution rail. The actuator, in the EFC pump, controls the amount of fuel going into the rail, controlling the rail pressure. The quantity of fuel delivered to the combustion chamber is the result of the rail pressure level and the speed dependent time for that pressure to fill the injectors pumping chamber. This means of control is also known as the Cummins PT (Pressure/Time) fuel system.

The Cummins PT fuel system can be standalone or include an Electronic Fuel Control (EFC) either as a Normally Open or Normally Closed system with its actuator integrated in the PT pump, or it may use a mechanical / hydraulic governor

externally linked to the PT pump. GAC has actuator and governor solutions for each control system offering Isochronous, Droop, and Variable Speed operation. Cummins PT Governor System Replacement Options:

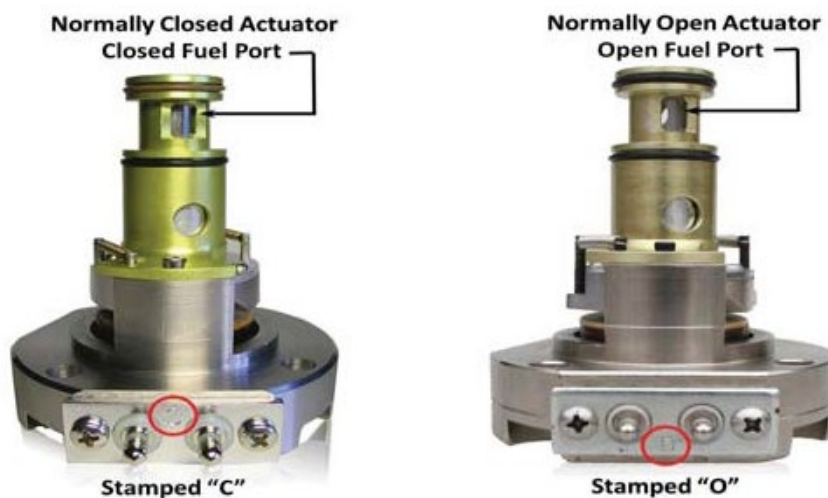
- Replace PT pump EFC actuator system with GAC integrated metering valve / actuator (ADB120E4) and GAC speed controller, replacing Cummins control system. Installation steps and additional hardware are dependent on whether the EFC actuator is Normally Open or Normally Closed.
- Add GAC speed controller and retain the existing EFC actuator. Speed controller choice is dependent on whether the EFC actuator is Normally Open or Normally Closed.
- Replace existing mechanical / hydraulic governor with GAC 225 Series actuator. No EFC actuator is involved.

## IDENTIFY NORMALLY CLOSED VS. NORMALLY OPEN PT EFC ACTUATOR

PT pump fuel systems use either NORMALLY OPEN and NORMALLY CLOSED integrated actuators. You must identify which type of actuator you have before replacement installation and before adding a GAC speed controller.

PT pump actuators often have the letter ‘C’, for NORMALLY CLOSED (NC), stamped between its terminals or the letter ‘O’ for NORMALLY OPEN (NO).

**FIGURE 1: IDENTIFYING EFC - NORMALLY OPEN OR NORMALLY CLOSED**



If the actuator is not externally identified, referencing Figure 2, complete the following:

1. Momentarily disconnect one terminal while the engine is idling:
  - a. If the engine stalls the actuator is a normally closed, forward acting valve.
  - b. If the engine accelerates it is a normally open, reverse acting valve. PT pump actuator terminals are connected directly to the governor.
2. Reconnect the terminal.

**FIGURE 2: EFC TERMINALS**

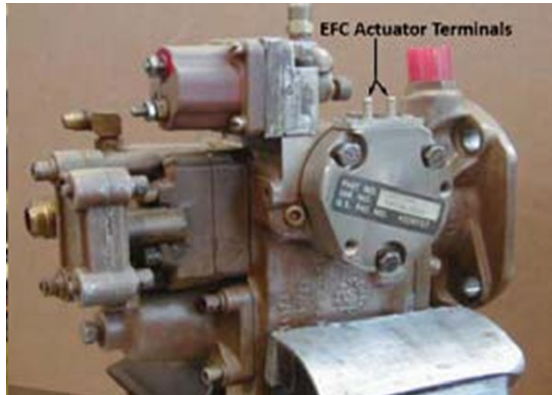


Table 1 lists the speed controller that corresponds to the EFC type.

## **REPLACING EFC SYSTEM WITH THE ADB120E4-GAC ACTUATOR**

When adding the GAC ADB120E4-GAC actuator, the actuator is added and depending on the EFC actuator type is either modified using the KT683 kit (NORMALLY CLOSED(NC)) or untouched (NORMALLY OPEN(NO)) . Plumbing changes as detailed in Figure 4, are required for both NC and NO ADB120E4 installations.

For an inoperable forward acting NORMALLY CLOSED PT pump actuator, the actuator must be removed from the pump before installing the new actuator.

For a REVERSE ACTING / NORMALLY OPEN PT system the ADB120E4 metering valve / actuator is installed with no fuel pump modifications beyond routing the external plumbing as shown.

The ADB120E4 is compatible with number of GAC speed controllers, the EEG6500, ESD5111 and ESD5500E and the GAC LCC series (Locomotive Controls).

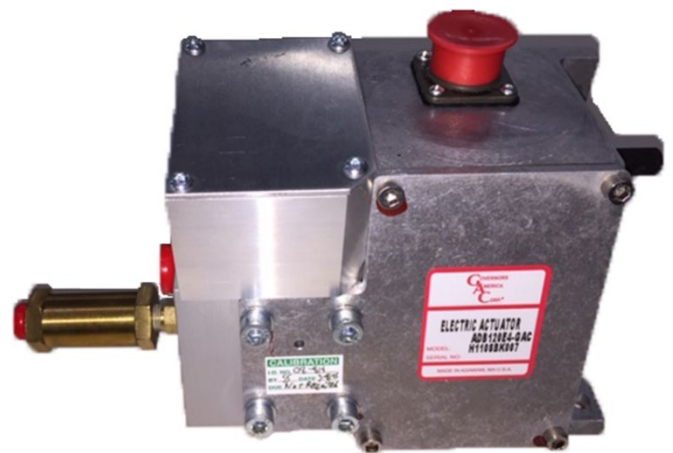
## **ADB120E4 FOR EFC REPLACEMENT INTRODUCTION**

The ADB120E4-GAC actuator offers improved performance:

1. Piston pin and lever apparatus are fully enclosed to eliminate external fuel leakage.
2. Piston pin to bore clearance increased to prevent sticking caused by debris.
3. Check valve in the actuator outlet circuit has offers improve forward flow and reverse flow check characteristics in the circuit.

Details on the ADB120E4 and its installation specifics are found in the [ADB120E4 installation manual](#).

**FIGURE 3: GAC ADB120E4-GAC**

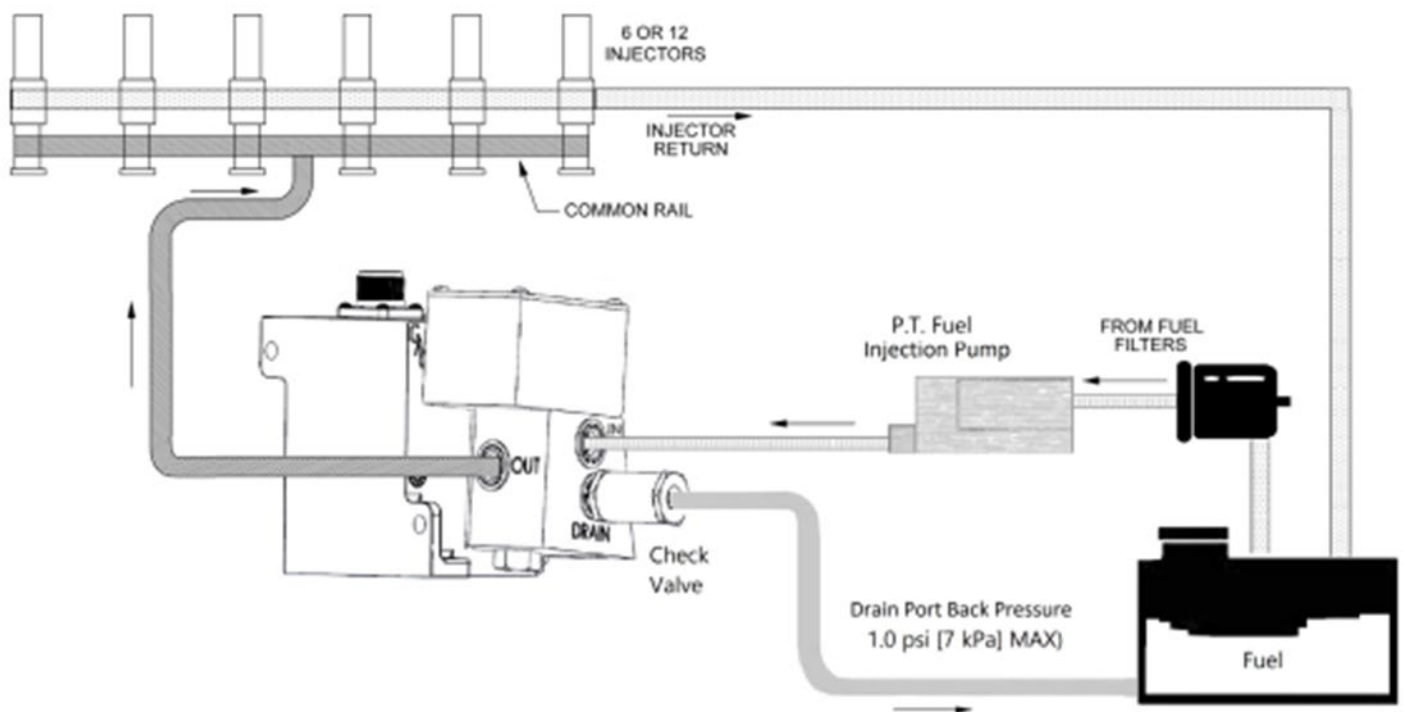


## PLUMBING CHANGES TO SUPPORT PT PUMP ACTUATOR UPDATE

GAC ADB120E4-GAC (Figure 3) is an integrated metering valve / actuator assembly that replaces the PT pump EFC actuator. Using the BK114 mounting bracket (optional) it can be installed on any Cummins engine.

1. Connect the discharge fitting of the PT fuel pump to the inlet of the ADB120E4-GAC valve. Inlet and outlet fittings are both 1/4" NPT threads.
2. Connect the outlet from the valve to the fuel rail that leads to the injectors (Figure 4).
3. The drain from the valve must be connected to the injector return line through the check valve, supplied with the actuator. A maximum of 1 psi (7 kPa) back pressure is acceptable.

**FIGURE 4: SYSTEM SCHEMATIC**



The ADB120E4-GAC metering valve / actuator assembly is installed on a Normally Open PT actuator with no fuel pump modifications beyond routing the external plumbing as shown.

## INSTALLING THE ADB120E4-GAC ON A NORMALLY CLOSED (NC) PT ACTUATOR

Use the following procedure for a Normally Closed PT actuator.

### REMOVE NC PT ACTUATOR (REFERENCE FIGURES 5 THROUGH 12)

1. Disconnect the engine starter battery and shut off the fuel supply before the filters.
2. Disconnect the electrical lines from the stop solenoid. CAUTION: The solenoid is polarized and the top screw is battery positive.
3. Once the fuel supply line is closed, remove the fuel inlet, and return from the pump (Figure 5).

**FIGURE 5: REMOVING FUEL INLET**



4. Remove the four flange mounting screws (Figure 6). Note, the pump has no timing device so clocking its radial position to the crank is not necessary. The pump is fuel lubricated so there should be very little engine oil to spill.

**FIGURE 6: REMOVE MOUNTING SCREWS**



5. Clamp the pump into a vise and remove the three mounting screws from the EFC actuator (Figure 7).

**FIGURE 7: REMOVE EFC MOUNTING SCREWS**





6. Pull the EFC actuator out from the PT pump, turning it slightly to overcome any resistance from the O-ring adhering to its bore. Ensure O-ring seal did not fall out and is still in pump gland (Figure 8).

**FIGURE 8: REMOVE EFC FROM PUMP WITH CAUTION**



7. Clean the pump's sealing surface making sure no debris particles or contaminants get into the pump (Figure 9).

**FIGURE 9: CLEAN SEALING SURFACE**



## **PREPARING THE PUMP FOR AN ADB120E4-GAC ACTUATOR**

1. Lift the gasket off the EFC actuator. Save the gasket for reuse during replacement of cover (Figure 10).

**FIGURE 10: REMOVE AND SAVE EFC GASKET**



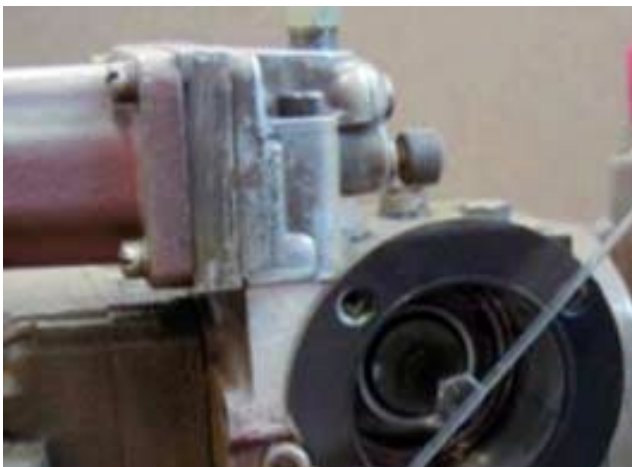
2. **IMPORTANT!** TO ENSURE THE PT PUMP IS IN THE OPEN MODE, insert actuator plug (GAC PN PG112 part of KT683) into the actuator bore . Ensure the O-ring seal from the kit is on the plug (GAC PN SE104-017N).
3. Mount the plug facing the pump as shown in Figure 11.

**FIGURE 11: INSERT PLUG FACING PUMP**



4. Insert an M5 x 0.8 hex head screw with a lock nut into hole plug part number PG112 (Figure 12). Select and adjust its length so the end of the hex head is flush with the cover mounting surface. The screw should just contact the cover plate to retain the hole plug in its position. Place the gasket onto the pump.

**FIGURE 12: INSERT CONNECTING HARDWARE**



5. Place the cover on the pump and torque the three screws to 2.8 N·m (25 lbf·in) (Figure 13).

**FIGURE 13: TORQUE COVER SCREWS**



6. Install the pump, actuator bracket, and actuator following the actuator installation instructions.
7. Connect the fuel line from the pump to the actuator and the line from the actuator to the rail.
8. Connect the drain from the check valve to the return fuel circuit.
9. Connect the fuel shut-off solenoid, the top terminal on the solenoid is positive.
10. Open the fuel supply to the filters.

**FIGURE 14: COMPLETED INSTALLATION**



11. Purge air from the fuel system. Cranking may take longer for the first start as the pump, metering valve, and fuel lines are refilled with a solid column of pressurized fuel.
12. Ensure the RPM setting on the speed control is properly set for an initial start, refer to specific literature for the speed controller being used.



## SELECTING A GAC SPEED CONTROLLER

Whether you are replacing the EFC actuator or only adding a speed controller, you must use the speed controller that supports the forward acting or reverse acting to match your EFC system. PT fuel systems use both NORMALLY OPEN and NORMALLY CLOSED integrated actuators. You must identify which type of EFC actuator you have to pick the correct speed controller.

**TABLE 1: SELECT THE COMPATIBLE SPEED CONTROLLERS FOR THE NO AND NC ACTUATORS**

GAC Speed Controller PN	Normally Closed / Forward Acting EFC Actuator	Normally Open / Reverse Acting EFC Actuator
EEG7500	X	
EEG7000	X	
EEG6500	X	
ESD5522E	X	
ESD5120	X	
ESD5119		X
ESD5160		X

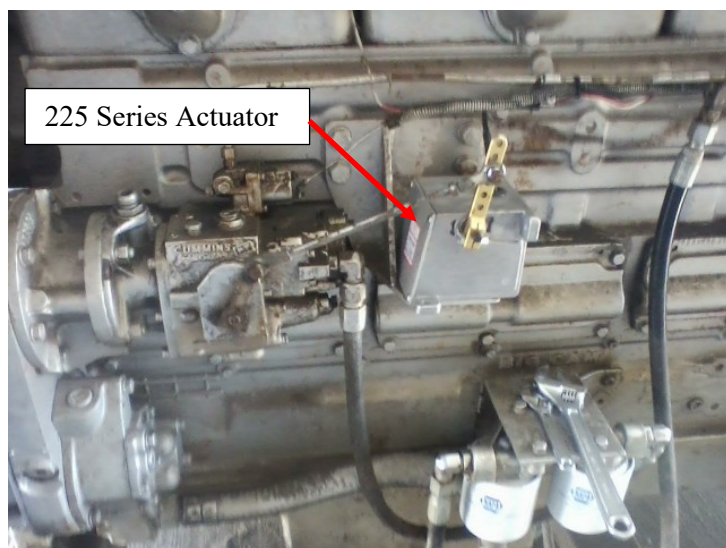
## INSTALLING GAC 225 on PT PUMP WITH MECHANICAL / HYDRAULIC GOVERNOR

GAC recommends using the **ADC225JS-12/24** universal actuator to control a PT pump with a mechanical or hydraulic governor. The ADC225JS-12/24 has a higher rate internal return spring for optimum RPM stability, commercial connectors, lever assembly and 7 foot (2131 mm) mating harness.

- The actuator must be rigidly mounted as close as possible to the PT pump using the BK267 (optional).
- The 225 will only work if replacing a unit that has either an existing mechanical or hydro mechanical governor. Its not meant to replace an EFC equipped engine.

Following the [installation instructions for the 225 Series actuators](#), install the **ADC225JS**.

**FIGURE 15:PT PUMP UPDATED WITH GAC ADC225JS**





**TABLE 2: SPEED CONTROLLERS FOR ADC225JS-12/ 24 ACTUATORS**

<b>GAC Speed Controller PN</b>	<b>Digital</b>	<b>Analog</b>
EEG7500	X	
EEG7000	X	
EEG6500	X	
EDG6000	X	
ESD5111		X
ESD5131		X
ESD5221		X
ESD5500-II		X
ESD5500E		X

For additional installation instructions refer to individual product literature go to [GOVERNORS-AMERICA.COM](http://GOVERNORS-AMERICA.COM).