

# **3406 B/C PEEC Repair Manual**

**3406B – 8TC**

**3406B – 5YG**

**3406B – 2EK**

**3406C – 4CK**

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# 3406 PEEC Introduction

The 3406 PEEC evolved from the legendary 3406 mechanically governed engine with the addition of an electronic control module (ECM). The ECM controlled major functions of the engine such as engine timing and fuel rate by using actuators. The ECM also monitored the engine through electronic sensors including speed, rack and timing, boost, oil, and coolant temperature

The 3406B PEEC engine was introduced in 1987 and remained in production until 1993. During the six year production cycle, Caterpillar built over 32,000 PEEC engines and many are still in operation today. Serial number prefixes for 3406B/C PEEC engines are:

- 8TC – 3406B - 1987 to 1990
- 5YG – 3406B - 1990 460Hp engines only
- 2EK – 3406B - 1991
- 4CK – 3406C - 1992 - 1993

During this production span, enhancements were made to the engine to not only meet new EPA emission regulations, but to improve engine performance and fuel economy.

The following “reminders” are given to aid in the troubleshooting of PEEC engines. Each item contains a brief description. If further clarification is needed please refer to the appropriate Service documents.

## 1. ENGINE OIL LEVEL

- It is imperative to maintain the correct engine oil level.
  - The proper oil capacity for PEEC engines is 39 liters (40 quarts)
  - Do Not exceed this level
  - Verify that the dipstick is properly marked for the 39 liters (40 quarts)
  - A suction bell shroud is recommended

## 2. OVERHAUL or High Mileage

- If the engine is overhauled with a standard or OPT overhaul, the Injection Pump should be inspected and the following parts replaced
  - Fuel Camshaft bearings
  - Rack bar bushings
  - All seals in the timing advance unit

## 2. DERATE SOFTWARE (Engine Protection and ESC)

- This software was developed in June 1997.  
Information about this software release can be found in SEBE6122.
  - This offering also made available a 2 year/Unlimited Mileage ESC.
  - This coverage warranted ALL electronic engine components.
  - The program is ‘STILL AVAILABLE’ if the truck has less than 650,000 miles.

## 3. “INTERMITTENT FAILURE ANALYSIS MANUAL” (SENR6425)

-Available to aid technicians if Service Manuals do not provide enough details.

## 4. IMPROVED ELECTRONIC COMPONENTS

-Over the years new components have been developed. Be aware of updated or improved components listed below:

- a. Rack Sensor
- b. PEEC II and PEEC III
- c. Shutoff solenoid

- d. Transducer Module
- e. Speed Sensor
- f. ECM
- g. Timing Advance

## **REPAIR OPTIONS (After Failure)**

Caterpillar factory and dealer personnel as well as TEPS dealer personnel have been challenged with 3406 PEEC failures. The primary objective is to repair the engine with minimal cost to the customer. An experienced PEEC technician should consider all of the component enhancements and consider replacement/upgrade of all affected components. The customer should be made aware of potential problems if these replacements/upgrades are not done.

In the event of major component failure and/or engine failure, the customer should be informed of all options available to put the truck back in operation. The following is a list of brief repair options that could be considered.

### **Option 1**

Repair all known failed iron/electronic components as necessary. Cost unknown until complete.

### **Option 2**

Replace the PEEC engine with a 3406B Mechanical engine (350 and 425hp are only options)

Engine @ Dealer Net	\$10,386.00
New Engine Upcharge	\$542.00
Dealer Profit (20%)	\$2,080.00
Labor	\$1,000.00 Minimum
<b>ESTIMATED TOTAL</b>	<b>\$15,008.00</b>

### **Option 3**

Replace the PEEC engine with a 3406E (any hp)

Engine @ Dealer Net	\$13,485.00
New Engine Upcharge	\$2,500.00
Dealer Profit (20%)	\$2,700.00
Labor	\$2,000.00
<b>ESTIMATED TOTAL</b>	<b>\$21,045.00</b>

There are more repair options than listed above. An important point to remember is that the REMAN Engine has a 2-year warranty. Parts repaired have only 1-year warranty.

# PEEC Overview

## PEEC Electronics

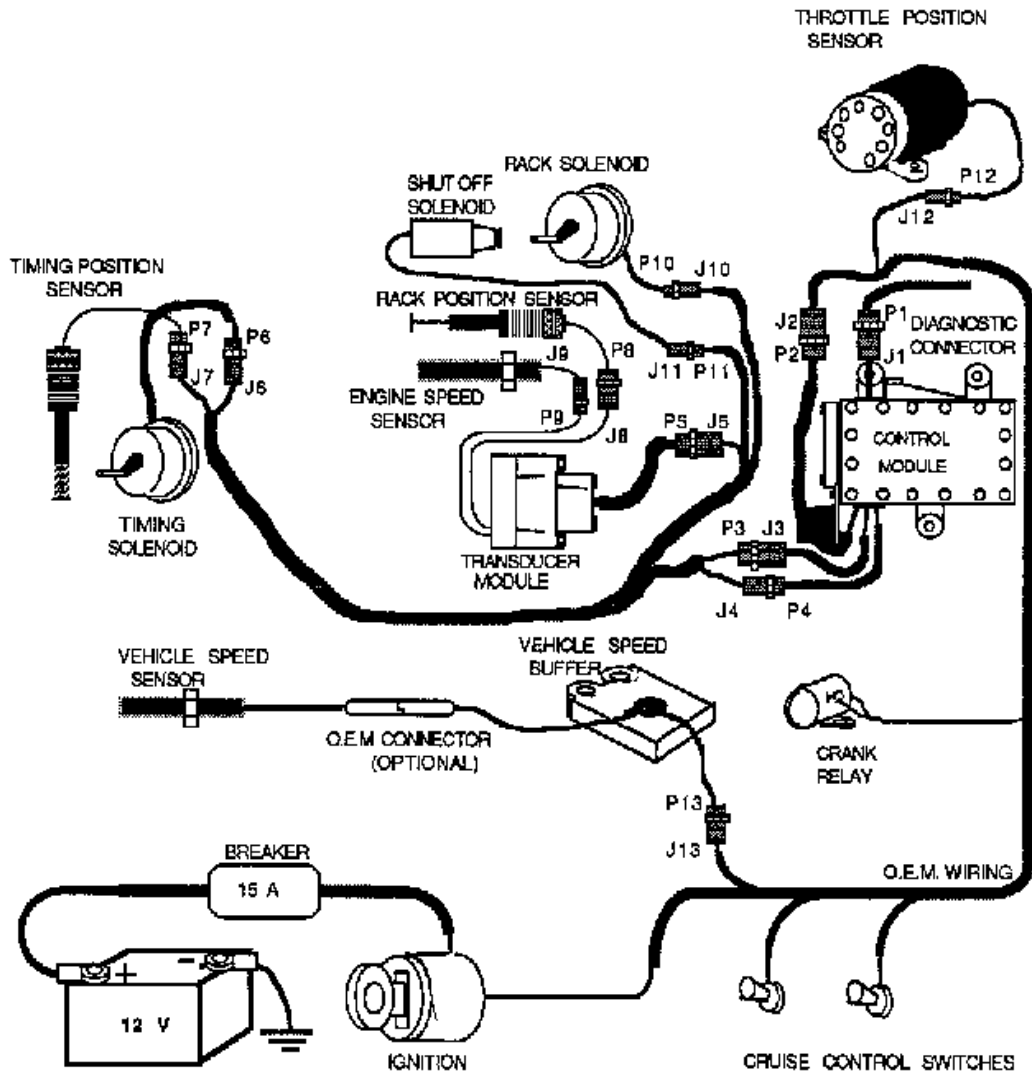


Illustration 1 – PEEC 2 System Diagram

## **PEEC II vs. PEEC III**

### **-PEEC II**

Approximately 15,000 Produced  
8TC, 2EK, 5YG Serial Number Prefixes  
Bolt-on Personality Module

### **-PEEC III**

Approximately 25,000 Produced  
4CK Serial Number Prefix  
Plug-in Personality Module  
"Fast" Cam  
Enhanced Diagnostics  
Single 40 Pin ECM Connector  
Dedicated Data Link Connector  
Coolant Temperature Sensor Added  
18 Programmable Parameters

## **3406B/C vs. 3406E/C-15/C-16**

### **Similarities**

- Both engines use Throttle Position, Cruise Control, and Customer Parameters to constantly determine a desired engine speed.
- Both engines use an Electronic Governor (software) to select a desired fuel rate based on the difference between actual and desired engine speed (2 sensors on 3406E/C-15, 1 sensor on PEEC).

### **Differences**

- 3406E/C-15/C-16 - Directly fires each injector.
- 3406E/C-15/C-16 - Determines fuel rate by injector "on time".
- 3406E/C-15/C-16 - Electronically references top dead center to control timing.
- PEEC Controls fuel rate by using the BTM to control a hydraulic servo, which moves the rack bar and changes the scroll settings on the plunger and barrel assemblies.
- PEEC Determines fuel rates by measuring the rack bar travel.
- PEEC Controls timing by hydraulically advancing the camshaft with respect to the crank using a BTM, servo, and position sensor.
- PEEC Rack and timing sensors need to be calibrated when replaced.

# **Common Failure** **Modes**

## A. TIMING ADVANCE FAILURES

Timing advance failures have occurred on 2EK and 4CK engines. The January 1995 TEN article (included) summarizes **nine improvements** that should be checked before releasing a truck with a failed timing advance unit.

**Recently, the fuel camshaft bearings have been shown to be a contributor to timing advance failures. These bearings should be replaced as part of an OPT or normal overhaul. They should also be checked for wear, on any engine that has high mileage and multiple timing advance failures.**

In addition to the nine improvements, there are two Service Letters that should be mentioned. **Service Letter PS8200** (Increase Oil Sump to 40 Quarts) and **Service Letter PI3005** (Install De-rate Software to Limit Contingent Damage After Timing Advance Failure).

These Service Letters are included in this chapter as well as Truck Engine News articles that relate to this subject.

### Truck Engine News

Media Number - SEBD6662-00 Publication Date - 1995/01/01

## Electronic Timing Advance Improvements

1272, 1253, 1264

**3406B (8TC, 2EK),**

**3406C (4CK) Truck Engines**

Numerous improvements have been made to the electronic timing advance components on these truck engines. The Steps that follow provide a way to check the electronic timing advance components to determine if the latest components and improvements are incorporated. Use the chart to determine which Steps apply to your engine.

Engine S/N Range	Applicable Step(s)
8TC1 - Up	1 - 4, 6 - <b>10</b>
8TC1 - 13234	5, <b>10</b>
2EK1 - Up	1 - 4, 7 - <b>10</b>
2EK1 - 01823	6, <b>10</b>
4CK1 - Up	3, 7, 9, <b>10</b>
4CK1 - 2537	1, <b>10</b>
4CK1 - 6001	2, <b>10</b>
4CK1 - 11473	4, <b>10</b>
4CK1 - 15840	9, <b>10</b>