

HPSGEN3

Detached Connector

Problem Description

- › 28th of June 2019, Continental determined about detached connector on GDI06
- › Part was found during End Of Line test
- › Serial number of the part and production date in Trutnov is G61817730D
 - › Part was produced in Trutnov 26th of June 2018
 - › Fuel Rail Assembly in NPN was done 29th September 2018
- › Second group of sensors found in external warehouse with detached connector

Problem visualization

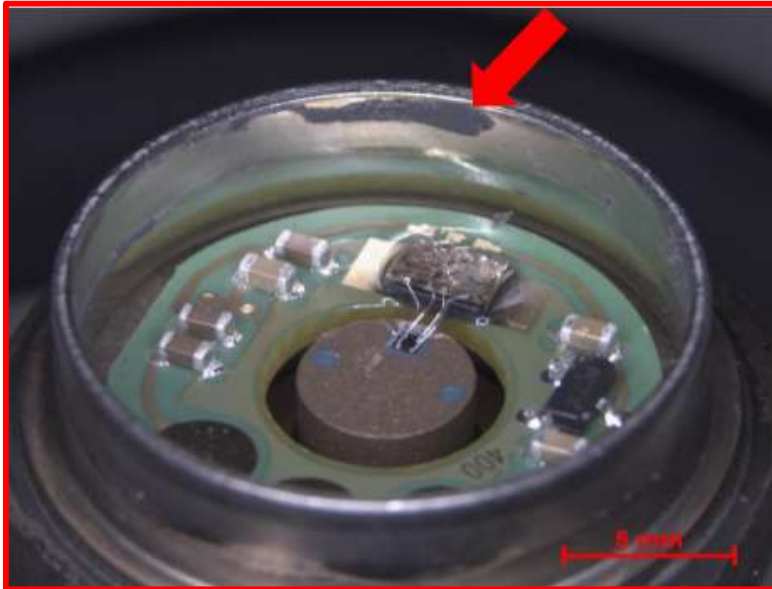


Part analysis (destructive test)

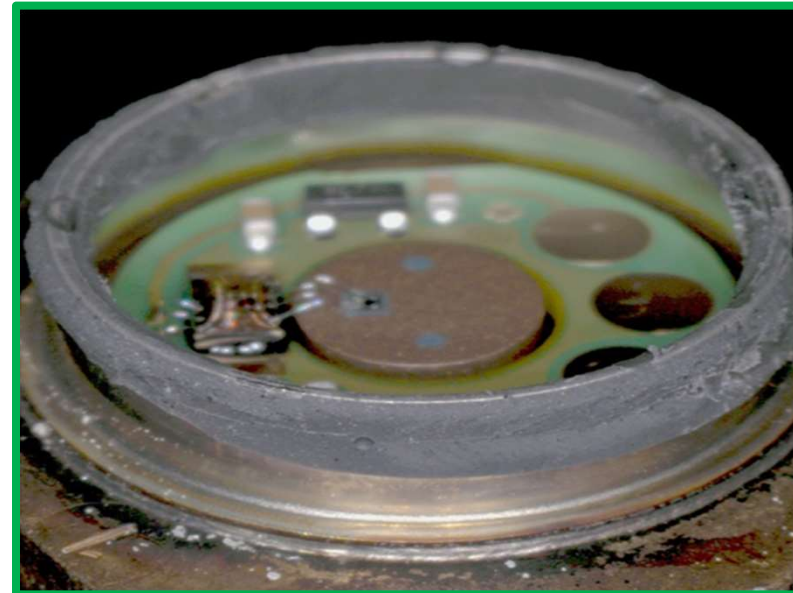
> Metal ring inspection

- > Small remains of glue inside metal ring
- > No visible glue residues on the outside of the ring

NOK - Small remains of glue on the whole ring



OK part
Standart condition of glue in TRU



Hypotheses

Summary

A fluid (or vapour) has attacked the glued joint and caused failure.

Background

The bond between glue and steel ring is primarily a chemical bond at the passivation layer on the metal surface. It can be destroyed chemically by certain fluids if they get into the joint. This scenario is proven. The glue material is not harmed; only the atomic bonding between the glue material and the steel's passivation-layer material.

Chemical attack is highly temperature dependant, faster at high temps. For some fluids the rate of attack is only significant above a certain temperature. To progress through the full 4 mm thickness of the band of glue takes time. In other words, the right metric is 'Time@Temp'.

Finally there will be an entire dis-bond of the glue leaving a clean ring (which we see here).

Therefore the presence of a disruptive fluid (or vapour) is an essential pre-requisite for this failure mode. There are several hypotheses about what this fluid or vapour could be and where it came from.

Hypotheses (Continued)

| Hypothetical fluids or vapours causing the failure | |
|--|--|
| A | A unique (but unidentified) fluid used by NPN (but not in Pisa and TRU) during manufacture of the rail assembly or maintaining the machines |
| B | The calibration fluid (called Cal-fluid) used in production process by Trutnov when adjusting the sensor's Pressure transfer-function. Memo; previously considered harmless to the bond but hypothetically harmful at <u>exceptionally</u> high values of 'Time@Temp'. |
| C | A mixture of Cal-fluid and the Acetone used by NPN to clean reworked rails |

Weaknesses of Hypothesis A and B

Hypothesis A; Damage by a fluid in NPN

- (1) Do NPN use such a fluid and can it contaminate the sensor?
- (2) Was there a change? Was this fluid a recent addition to the process?

Hypothesis B; Damage by the Cal fluid used in TRU

- (1) Is it plausible that Fuel Rails transported from PISA experience lower Time@Temp than from NPN ?
- (2) What is different about the summer 2019 compared to previous summers?

Countermeasures & Risk Assessment

Risk Assessment

It is not possible to make a sensible assessment without knowing what is the problem fluid.

For example, the assessment would be different if it were Trutnov's Cal. fluid (which has been used all of the last 4 years) compared to if it were a fluid used in NPN which was introduced more recently.

So top priority is to identify the fluid.

Countermeasures

100% capable automatic 100N test before delivery out of Trutnov
Introduction of Overmold connector as Final corrective action due date
cw40.