

971 – Fuel Delivery and Suspected Fuel Vapor Lock

Vehicles Affected

| Models | Model Year | Model Type | VIN Range | Vehicle-Specific Equipment |
|----------|------------|------------|-----------|----------------------------|
| Panamera | As of 2017 | 971 | N/A | N/A |

Revision History

| Revision | Release Date | Changes |
|----------|-------------------|----------------------|
| 0 | November 29, 2021 | Original document |
| 1 | February 22, 2022 | Fault Tree revisions |

Condition

Customer complains of a check engine light resulting from faults in the **DME** (e.g. DME V8 TFSI (ULEV/C6B)) for:
 P008700_ Fault 000B16 "Fuel high-pressure system, pressure – below limit value"
 and/or
 P01C800_ Fault 00403E "Fuel high-pressure system, bank 2, pressure – below limit value" accompanied by misfires, stalling and or a rough idling engine.

Technical Background

Controlled spark ignition over a wide-range of operating conditions (e.g. temperatures, altitudes) necessitates the altering of a fuel's volatility, or its vapor-forming characteristic as a function of temperature. Emissions reduction is also an optimization parameter considered for fuel formulation. The standard imposed by the Environmental Protection Agency to establish volatility tolerancing, establishes limits based on geographic region and calendar month. Design requirements for fuel delivery systems allow for such in fuel volatility; nonetheless, large deviations from allowed tolerances can cause delivery and injection issues resulting from a condition referred to as vapor lock. Vapor lock, characterized here as the premature vaporization of fuel in the delivery system prior to combustion, can cause the symptoms described in the 'Condition' section above. During colder months in colder regions, fuel volatility (vapor pressure) will be higher as compared against months where the average temperature is warmer. If this volatility exceeds established tolerances, especially at higher ambient temperatures and or higher altitudes, vapor lock can result, causing a loss of fuel pressure, thereby disrupting delivery.

However, it is important to first diagnose and rule out other causes before deeming vapor lock the suspected culprit.

Service Information

In an ideal diagnostic scenario, complaints for G2 vehicles consistent with the information provided above will be reproducible; and the same gasoline will be in the fuel tank as when the initial error experienced by the customer occurred. To reproduce suspected vapor lock, the engine should be idling at operating temperature, standing safely in an area that is warmer and without wind to avoid convection cooling of the radiator and other thermal components. The vehicle may need to idle for 15 min or more at operating temperature to develop possible vapor lock. If the issue is reproducible, logging actual values with PIWIS Tester is useful to check both the low-pressure and high-pressure delivery circuits for possible causes before proceeding into diagnosis.

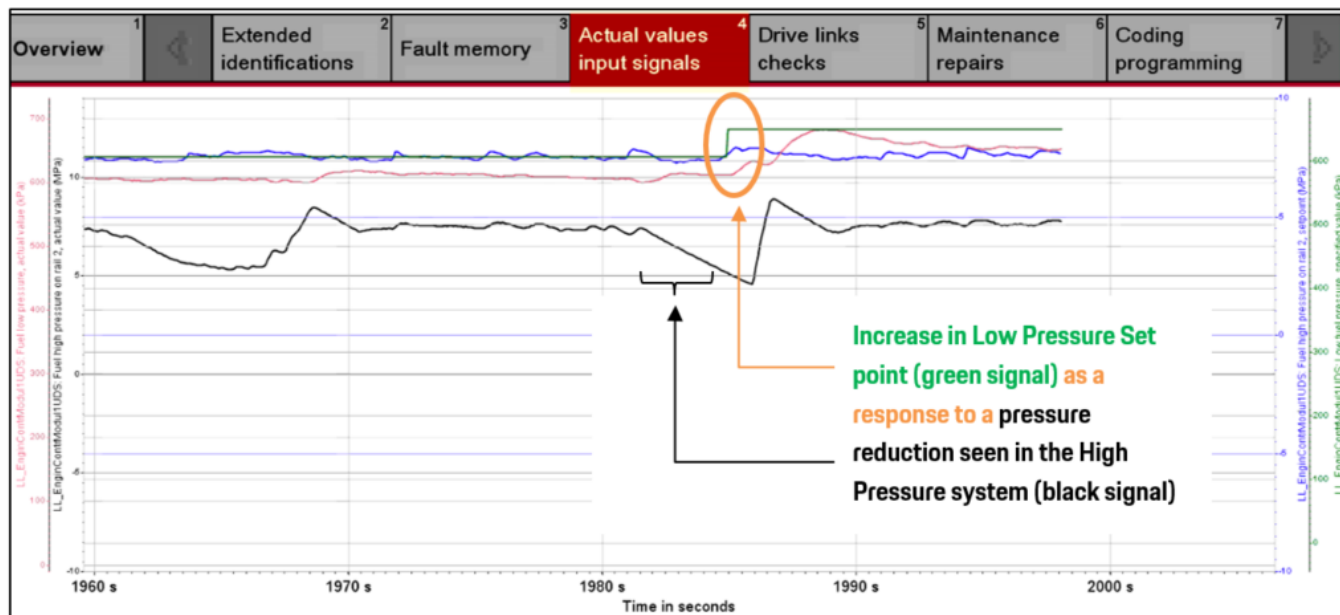


Figure 1 - Fuel Pressure Operation at Idle of a G2.I Configured with V8

Actual: Low-pressure fuel (≈ 5.5 – 6.5 bar)

Set point: Low-pressure fuel (6 – 6.5 bar)

Actual: High-pressure fuel bank (≈ 70 bar at idle)

Set point: high-pressure fuel bank 2 (≈ 70 bar at idle)

Figure 1 cites an example of properly functioning high and low pressure fuel circuits. The signals in Figure 1 illustrate the behavior of the low-pressure circuit as controlled by the DME when significant drops in high-pressure occur. (This specific function only exists in V8 equipped order types.) Specifically, we see the step-change in the low-pressure set point from 6 to 6.5 bar (green) to better supply the high-pressure circuit. The result in this instance is a correction to both the low- and high-pressure fuel systems, as witnessed by their respective actual values. In instances of extreme fuel volatility, vapor lock can otherwise result (see Figure 2). The design countermeasure exhibited in Figure 1 can be helpful in most cases, but might not remedy all highly volatile situations. It is important to first diagnose the high- and low-pressure circuits individually, starting with the low-pressure side, to rule out any physical issues with the systems (e.g. a blockage and/or a faulty fuel pump).

| Panamera 97ADG1 / 2019 | | | | | | |
|--|------------------------------------|--|-----------------------------|--------------------|---------------------|--------------------|
| Current actual values/input signals | | | | | | |
| Switch displays by pressing [F8]. Switch to actual values/input signals selection by pressing [F11]. | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Overview | Extended identifications | Fault memory | Actual values input signals | Drive links checks | Maintenance repairs | Coding programming |
| Control unit | Type | Name | | Value | Unit | |
| DME V8 GTS 4.0L USA (LEV3) | Bank 2 | Fuel high pressure on rail 2, actual value | | 0.6460 | MPa | |
| | | Fuel high pressure rail 2, control deviation | | 16.3835 | MPa | |
| | | Fuel high pressure on rail 2, setpoint | | 22.5080 | MPa | |
| | Bank 1 | Fuel high pressure, actual value | | 0.6480 | MPa | |
| | | High fuel pressure, control deviation | | 16.3835 | MPa | |
| | | High fuel pressure, specified value | | 22.3020 | MPa | |
| Low Pressure okay ✓ | Fuel low pressure, actual value | | 648.3 | kPa | | |
| | Low fuel pressure, specified value | | 650.0 | kPa | | |
| | | Fuel temperature | | 101.3 | °C | |
| | | Coolant temperature | | 105 | °C | |

Figure 2 - Significant High Pressure Deviations, Banks 1 and 2

In contrast to Figure 1, the example in Figure 2 suggests the low-pressure fuel supply is functioning properly, but both high-pressure supplies for banks 1 and 2 are not.

If both the high- and low-pressure fuel delivery systems function as intended when trying to replicate the issue, but do not alleviate the concern, then please log the behavior of the system consistent with the signals and method used in Figure 1 (i.e. four fuel channels displayed in one graph). If the fuel quality is suspect, please collect a sample from the fuel in the vehicle for testing in accordance with ATI 2130. Please remove the suspect fuel from the tank and refill with fuel from a known, trusted and reliable source. Alternatively, refill from a pump or gas station used regularly by the business in its service and repair of Porsche vehicles. Afterward, please repeat the same diagnostic test used to replicate the suspected vapor lock, ensuring the issue is resolved. If the issue is not resolved, please also collect a fuel sample from the known, 'good' source per ATI 2130. From this point, follow the rest of the procedure outlined in Figure 3 below.

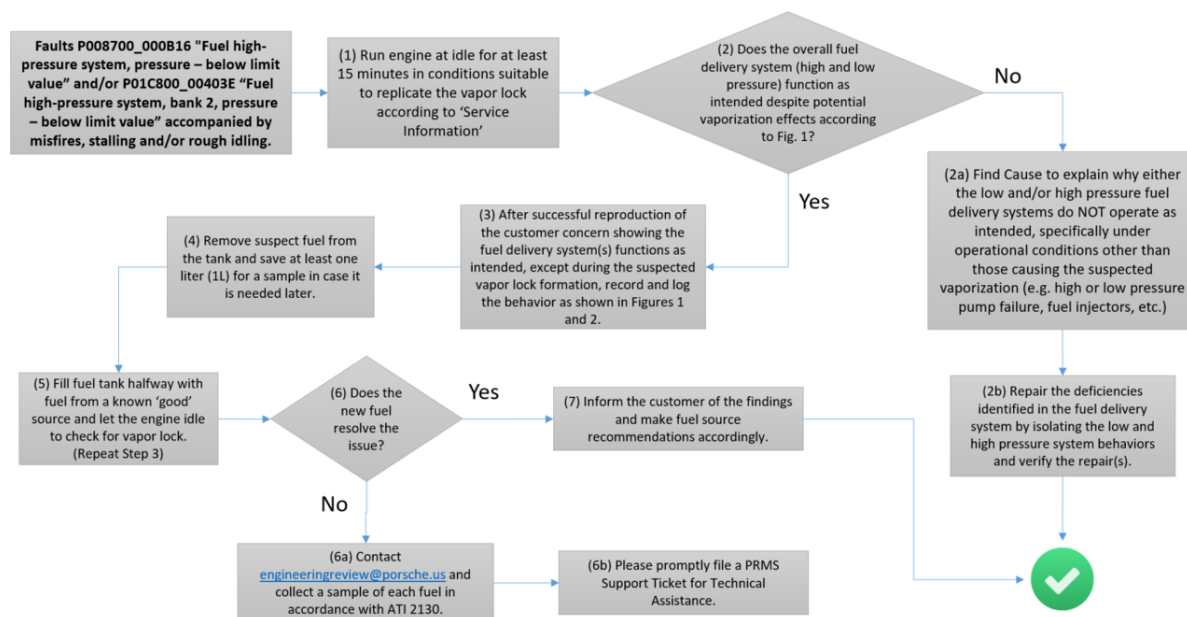


Figure 3 - Fault Tree for Diagnosing Suspected Vapor Lock

Upon arriving at 'Steps (4) and (5)' of Figure 2 please consult ATI 2130.

Warranty

As always, please document the repair completely in PQIS.

For this repair, please code the "cause" as follows:

Cause location: 20030 Fuel
 Cause symptom: 5061 pressure too low

Use the following troubleshooting labor operation:

20029599 Checking low- and high-pressure fuel systems (100 TU)
 20031750 Fuel drain and fill (78 TU)

Search Items

Vapor lock, vaporization, low-pressure fuel system, high-pressure fuel system, P008700_000B16 "Fuel high-pressure system, pressure – below limit value" and/or P01C800_00403E "Fuel high-pressure system, bank 2, pressure – below limit value", vapor pressure, winter fuel blend

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