MANUFACTURER & PRODUCT INFORMATION

Manufacturer: Porsche Cars North America, Inc.
Products: MY 2001-11 Porsche 911 with Turbo, GT2 and GT3 engines
Population: 24,635 (Estimated)

Problem Description: Rapid coolant loss caused by coolant pipe fitting failure, allegedly resulting in vehicle disablement and/or loss of vehicle control due to reduced traction for the affected vehicle or following traffic.

FAILURE REPORT SUMMARY

<table>
<thead>
<tr>
<th></th>
<th>ODI</th>
<th>Manufacturer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complaints:</td>
<td>57</td>
<td>9</td>
<td>63**</td>
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<tr>
<td>Crashes/Fires:</td>
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<tr>
<td>Injury Incidents:</td>
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<tr>
<td>Fatality Incidents:</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>Other*:</td>
<td>0</td>
<td>336</td>
<td>336</td>
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*Description of Other: Warranty claims for coolant leakage of any degree caused by the failure of an adhesive bond.

** Total eliminates duplicates received by ODI and manufacturer.

ACTION / SUMMARY INFORMATION

Action: This Preliminary Evaluation has been closed.

Summary:
On April 26, 2013, the Office of Defects Investigation (ODI) opened PE13-009 to investigate 10 complaints alleging incidents of sudden coolant loss while traveling on public roadways in certain model year (MY) 2001 through 2007 Porsche 911 vehicles. The complaints alleged that pipe ends joined by epoxy to certain cooling system components may fail suddenly and separate, resulting in large volumes of coolant leakage. The investigation was opened to assess evidence of a design or manufacturing defect in the coolant pipe fittings and any related safety consequences.

In response to ODI's Information Request letter, Porsche identified a manufacturing quality issue with the supplier's application of adhesive to coolant pipe fittings that resulted in elevated failure rates in approximately 6,800 early production 997 generation vehicles (MY 2007 and early MY 2008). ODI's analysis of field data showed that the age-adjusted failure rate for these vehicles was approximately six times greater than MY 2001 through 2005 996 generation vehicles and MY 2008 through 2011 997 generation vehicles built after a process improvement for adhesive application was implemented by the supplier.

Most of the leak complaints reviewed by ODI did not appear to involve complete separation of the fittings and many were detected when the vehicle was parked. There were no crashes or injuries reported to be related to the alleged defect in any of the subject vehicles. ODI identified two allegations that coolant leakage resulted in loss of control incidents, but neither involved vehicles affected by the assembly process quality issue. A third loss of control allegation involving a vehicle built during the period affected by the supplier process concern is not counted since ODI was unable to contact the owner to confirm the incident. See the full closing resume in the document file for PE13-009.
for additional information about the subject cooling system and ODI’s analysis of field data related to the alleged defect.

A safety-related defect has not been identified at this time and further use of agency resources does not appear to be warranted. Accordingly, this investigation is closed. The closing of this investigation does not constitute a finding by NHTSA that a safety-related defect does not exist. The agency will monitor this issue and reserves the right to take further action if warranted by the circumstances.
PE13-009 reviewed design, manufacturing and field data for all Porsche 911 vehicles using coolant pipe fittings joined by adhesive bonds. Porsche used epoxied coolant pipe fittings in approximately 24,635 MY 2001 through 2011 911 vehicles equipped with Turbo, GT2 and GT3 engines. These vehicles include approximately 11,688 MY 2001 through 2005 996 generation vehicles and 12,947 MY 2007 through 2011 997 generation vehicles. The full cooling system layout and close up view of the engine block for the 997 generation vehicles are shown in Figures 1 and 2 in the attachment pages for the full closing resume.

Part sales data provided by Porsche showed the water neck assemblies to be the most frequently replaced component using epoxied pipe fittings in the cooling system, with total sales 72% higher than the next highest component (water pump housing). Figures 3 and 4 show the water neck assemblies used in the 997 GT3 and Turbo/GT2 vehicles, respectively. Located at the outlet for cylinders 1-3, the water neck assemblies are exposed to some of the highest operating temperatures in the cooling systems of the subject vehicles, both during driving and hot soak (period following key off) conditions.

In its response to ODI’s Information Request letter for PE13-009, Porsche noted that the water neck is located behind the rear axle in the subject vehicles (Figure 5) and stated that leakage that occurs when the vehicle is in motion will be drawn further away from the rear tires by air flow. In addition, the rear tires are shielded from fluid leakage in the engine compartment by plastic liners in the wheel wells (Porsche noted that some owners may remove the wheel well liners as part of a number of modifications associated with vehicle performance and/or appearance that may have some effect on cooling system performance or the potential consequences of coolant leakage). Figure 6 shows coolant leakage from a water neck on the pavement beneath a complaint vehicle and provides an indication of leakage paths relative to tire position for a parked vehicle.

Porsche identified several factors that could result in degradation of the adhesive in the coolant pipe fittings: 1) overheating of the water neck due to racetrack use; 2) variation of adhesive bead thickness and distribution within the joint due to manual application of adhesive; 3) installation of racing components (exhaust system, engine reprogramming, camshafts, aerodynamic kits, etc.) that may increase cooling system operating temperatures; 4) low coolant level; and 5) use of non-OEM approved coolants with unknown chemical compositions and potential negative effects on the subject adhesive.

Porsche provided information regarding an internal investigation and subsequent supplier process change related to the second factor, variation in application of the adhesive. In 2007, Porsche investigated claims related to pipe fitting failures in early production 997 generation vehicles and identified the cause as inadequate application of the adhesive. Short term countermeasures (improved employee training) were implemented by the supplier in July 2007 and by late January 2008 the supplier had introduced an automated metering device for application of adhesive on pipe adapters.

ODI estimates that vehicles produced after February 2008 should have parts produced using the new process and Figure 7 shows failure rates and supplier process issues by vehicle build quarter and Table 1 provides a breakdown of vehicle production and failure data by production period, vehicle generation and engine for the 911 vehicles using epoxied coolant pipe fittings. The highest rates were observed in the period ranging from the start of production for 997 generation vehicles through early 2008 when the supplier adhesive application process improvement was implemented.

Porsche does not believe that coolant leakage is likely to result in any loss of vehicle control either in the subject vehicles or in traffic following a subject vehicle during a coolant leak incident. Porsche indicated
that the “vast majority of leaks are slow leaks of very small quantities of coolant” that are detected by owners due to symptoms such as odor from ethylene glycol coolant, coolant observed under the car when parked, or the low coolant warning light. In Porsche’s assessment, these symptoms would be present for some time prior to the complete failure and separation of a pipe fitting from the water neck or other cooling system component (e.g., water pump housing). Porsche indicated that pipe separations are rare events and are unlikely to result in loss of vehicle control because of the location of the leaks, the limited amount of coolant that can leak from a separated fitting, and the dynamics of the leakage from a separated pipe connection.

The water neck is located on the upper portion of the engine block behind the rear axle. In the event of a disconnection of a water neck pipe fitting, Porsche estimated that the maximum amount of coolant that was available to leak was limited by the location of the coolant pump and much less that the total contents of the system (approximately 28 liters). Since the pump is positioned relatively high on the engine, the coolant that is available to leak is limited to the quantity in the over-flow reservoir and the volume in the engine block that is above the pump location, which Porsche estimated to be approximately 4 to 5 liters. Testing by Porsche indicated that the rate of leakage from a disconnected water neck pipe is limited by a plastic clamp which limits the displacement of the pipe to a few millimeters. In Porsche’s assessment, in this situation the leaked coolant would immediately expand and evaporate, consistent with complaints alleging steam coming from the engine compartment. Porsche does not believe that this is likely to result in a loss of traction or control to the incident vehicle or following traffic.

ODI’s analysis of field data received from consumers and provided by Porsche are summarized in Table 1 and shown in Figures 7, 8 and 9. The analysis found that problems with coolant pipe fitting leakage were concentrated in approximately 6,800 early production 997 platform vehicles. The 996 vehicles produced before this period and the 997 vehicle produced afterwards have similar failure rates after adjusting for exposure (Figures 7 and 8). Most of leak complaints reviewed by ODI did not appear to involve complete separation of the fittings and many were detected when the vehicle was parked. Some of the complaints alleging complete pipe detachments have alleged that coolant has contacted rear tires and reduced traction, with some noting the driver’s side rear tire is most affected. ODI was not able to verify the condition of the wheel well liners in those vehicles. Since neither Porsche nor NHTSA have conducted any testing under on-road operating conditions to assess the potential for leaked coolant to wet rear tires, the factors that may contribute to this remain unknown. However, based on review of information from field data, incidents alleging control issues are rare and most involved brief and controllable events.

ODI identified two allegations that coolant leakage resulted in loss of control incidents, but neither involved vehicles affected by the assembly process quality issue. A third loss of control allegation involving a vehicle built during the period affected by the supplier process concern is not counted in this analysis since ODI was unable to contact the owner to verify the allegation and incident details (ODI #10492870). Complaints alleging loss of control incidents appear to be random and isolated events and ODI’s analysis did not find any correlation between the increased failure rates observed in the early 997 production vehicles and loss of control incidents. There were no crashes or injuries alleged to be related to the alleged defect in any of the subject vehicles.
The ODI complaints cited in PE13-009 can be reviewed at www-odi.nhtsa.dot.gov/complaints under the following identification (ODI) numbers:

10409159, 10450233, 10491708, 10499809, 10508415, 10508439, 10508487, 10508502, 10508623, 10508852, 1050886, 10508894, 10508943, 10508950, 10508991, 10509008, 10509188, 10509344, 10510000, 10510187, 10510189, 10510191, 10510206, 10510232, 10510273, 10510337, 10510343, 10510346, 10510377, 10510442, 10510624, 10511011, 10511253, 10511347, 10511478, 10511549, 10511586, 10511600, 10511813, 10513491, 10513938, 10515138, 10515907, 10515918, 10519644, 10520217, 10521086, 10522635, 10523027, 10525242, 10525577, 10532180, 10533689, 10542207, 10547074, 10558119, 10559491
Figure 1. Isoview of complete coolant system, 997 generation (Porsche attachment 12-11).

Figure 2. Cooling system components on the engine block, 997 generation; components with adhesive bonded pipe fittings shown in green and water neck position shown by red arrow (Porsche attachment 12-10).
Figure 3. Water neck, 997 GT3, P/N 99710603990 (Porsche attachment 10-2).

Figure 4. 997 Turbo/GT2 water neck with separated pipe, P/N 99710603972.
Figure 5. X-ray illustration of the 997 GT3 showing the orientation of the water neck and the rear tires (Porsche attachment 12-5).

Figure 6: Photograph of coolant leakage on pavement showing position relative to rear tires (view from rear of complaint vehicle looking forward).
Figure 7. Failure rate by vehicle build quarter and supplier adhesive application process:
- Range A - 996 production with no adhesive application process issues identified;
- Range B - 997 launch issues with supplier adhesive application process control issues;
- Range C - supplier short term countermeasures implemented (employee training);
- Range D - supplier automated adhesive application process implemented.

Table 1. Field experience by vehicle generation, engine and build range; incidents related to coolant leakage from adhesive bonded fittings.
Figure 8: Cumulative failure rate by years in service by production period, total cooling system claims/complaints.

Figure 9: Cumulative failure rate by years in service by production period, evidence of coolant leakage from adhesive bonded connections.