



U.S. Department  
of Transportation  
**National Highway  
Traffic Safety  
Administration**

# ODI RESUME

Investigation: EA07-011  
 Prompted By: PE07-022  
 Date Opened: 08/14/2007  
 Principal Investigator: Derek Rinehardt  
 Subject: Engine Compartment Fire  
 Date Closed: 08/13/08

Manufacturer: BMW of North America, LLC. Bayerische Motoren Werke  
 Products: MY 2002 – 2003 Mini Cooper  
 Population: 50,000

Problem Description: Allegations of fire or smoke from the Electro-Hydraulic power-steering system.

## FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	37	17	52
Crashes/Fires:	6	3	9
Injury Incidents:	0	0	0
# Injuries:	0	0	0
Fatality Incidents:	0	0	0
# Fatalities:	0	0	0
Other*:	0	100	0

\*Description Of Other: Power steering pump warranty claims indicating thermal failure.

Action: This Engineering Analysis is closed.

Engineer: Derek Rinehardt DR

Date: 08/13/2008

Div. Chief: Jeffrey L. Quandt

Date: 08/13/2008

Office Dir.: Kathleen C. DeMeter

Date: 08/13/2008

Summary: The Office of Defects Investigation (ODI) analyzed consumer complaints to BMW of North America, LLC. (BMW) and to ODI that alleged failures of the Electro Hydraulic Power Steering (EHPS) used in Model Year 2002 through 2003 Mini Cooper vehicles. The analysis determined that 43 of the 52 (83%) reports were related to allegations of power steering loss and 9 (17%) were related to allegations of engine compartment fires.

Although some of the reports alleging fires note small flames were visible in the engine compartment, analysis of the damage caused by these failures indicates that even the most severe incidents were limited to localized thermal damage to the EHPS electrical connections and wiring insulation. None of the complaints alleging loss of power assisted steering indicated that the increased effort resulted in a crash or loss of vehicle control.

A safety-related defect trend 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 circumstances.

**ENGINEERING ANALYSIS CLOSING REPORT**

**SUBJECT:** Thermal failure of the Electro-Hydraulic Power Steering (EHPS) System

**EA No:** EA07-011

**DATE OPENED:** 08-14-2007

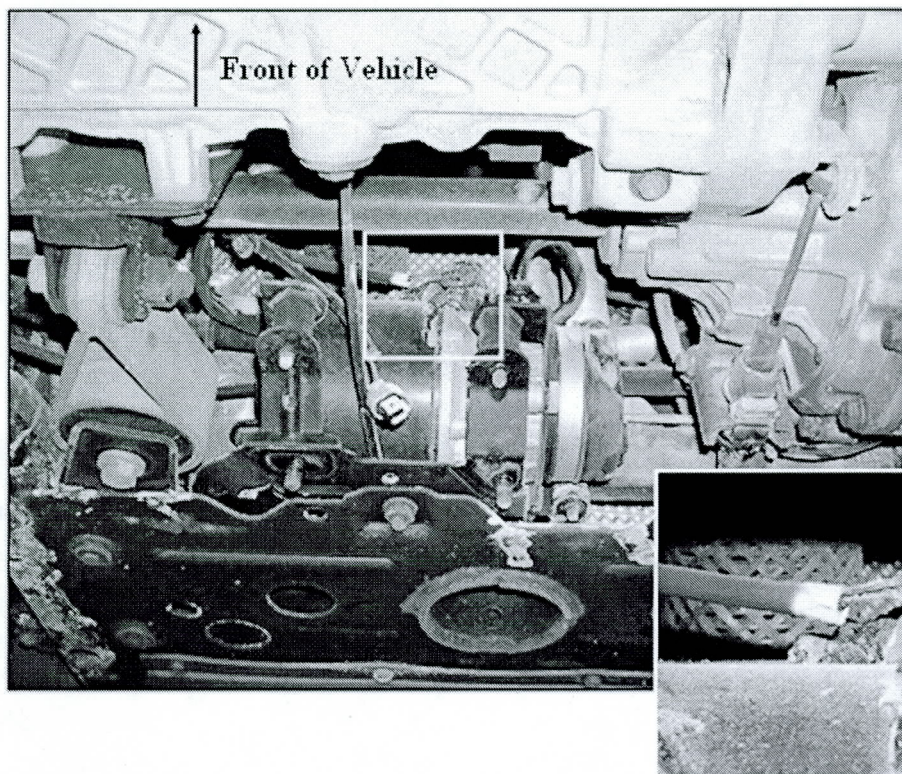
**DATE CLOSED:**

AUG 13 2008

**SUBJECT VEHICLES:** Model Year (MY) 2002 – 2003 MINI Cooper vehicles

**SUBJECT COMPONENT:** All components of the EHPS system, including the associated electrical wiring and fuse protection.

**ALLEGED DEFECT:** Thermal failure of the EHPS System.



**BASIS AND BACKGROUND:** An Engineering Analysis (EA), EA07-011, was opened as a result of upgrading Preliminary Evaluation (PE), PE07-022. The Office of Defects Investigation (ODI) opened PE07-022 based on 3 vehicle owner reports that alleged thermal failure of the EHPS system. One of the 3 complainants alleged that a fire occurred. The others complainants alleged increased steering efforts and shortly thereafter witnessed smoke coming under the hood. During the PE, ODI received 4 additional complaints alleging a fire occurred due to the thermal failure of the EHPS system. During the same time period, BMW of North America, LLC (BMW) which owns the "MINI" brand, responded to ODI's information request (IR) letter stating that the primary cause of the alleged defect is an insufficient seal of the ground cable of the power steering pump at its attachment to the chassis. BMW stated that water ingress could occur and the water could travel along the power steering pump power cable and come in contact with the power steering pump power cable connector. The connector could then corrode and a high thermal load condition can occur. According to BMW, this ultimately could result in a localized smoldering condition that does not propagate.

During the PE, ODI was aware of 22 complaints, combining consumer complaints to ODI and consumer reports provided by BMW, of thermal failures of the EHPS. In 8 of these complaints, consumers alleged witnessing flames in the engine compartment.

**SUBJECT VEHICLE POPULATION:**

Model Year	Population
2002	17,269
2003	33,156
Total	50,425

**DESCRIPTION OF THE SUBJECT COMPONENT:**

The EHPS provides a means to supply the driver with power assisted steering. The EHPS in the subject vehicles is primarily composed of an electro-hydraulic pump (see Figure 1), an auxiliary cooling electric fan (see Figure 2) and the associated wiring. The electric motor replaces the customary design whereby the hydraulic pump is driven by the engine via an ancillary belt. The EHPS is designed to save engine power, provide a reduction in fuel consumption, and requires less maintenance than customary belt driven systems.

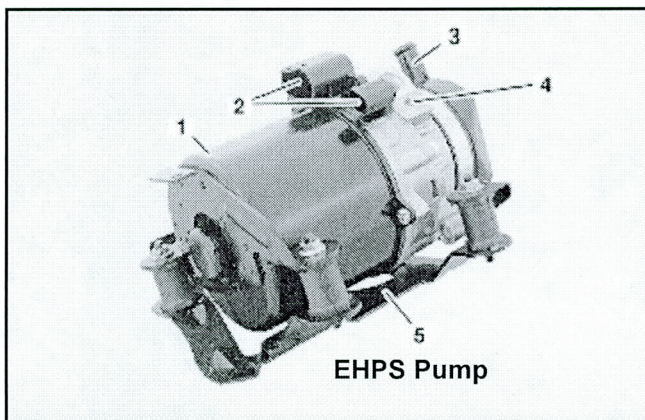


FIGURE 1

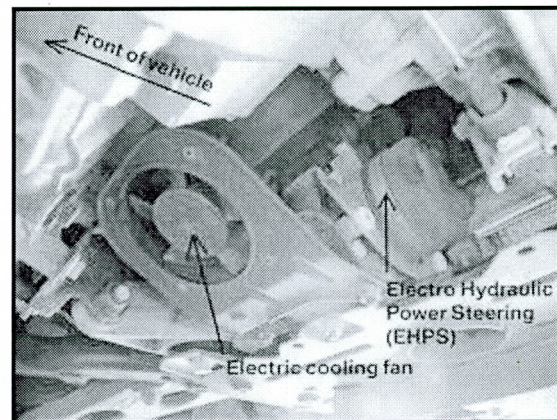


FIGURE 2

**CORRESPONDENCE:**

Date	Description
4/19/2007	Preliminary Evaluation (PE) Opening Resume
5/11/2007	PE Information Request (IR) Letter (from ODI to BMW)
7/27/2007	PE IR Response (from BMW to ODI)
8/14/2007	Engineering Analysis (EA) Opening Resume
8/15/2007	PE Closing Resume
3/14/2008	Update of Consumer Complaint and Warranty Claim (from BMW to ODI)

Table 1

**PROBLEM EXPERIENCE:**

<b>Field Experience - EHPS Thermal Failure</b>		
<b>ODI Complaints (Total / Fire Allegations)</b>	<b>BMW Consumer Reports (Total / Fire Allegations)</b>	<b>BMW Warranty Claims (Total / Fire Allegations)</b>
37 <sup>a</sup> / 9	17 / 15	100 <sup>b</sup> / 35 <sup>c</sup>

<sup>a</sup> 2 VOQs are duplicates with BMW complaints

<sup>b</sup> 3 VOQ VINs are also found warranty claim data

<sup>c</sup> Based on a verbatim text search using "fire" as the keyword. Many of these claims reference "overheated" or "melted" components. See ODI discussion of this report for further details.

**DESIGN, MATERIAL AND/OR PRODUCTION MODIFICATIONS:** In BMW's PE IR response, three modifications were implemented in production that potentially relate to the alleged defect.

**WIRING WATER INGRESS PREVENTION:**

- **Power steering pump connector revision**  
February 2002 – The connector terminal was changed from a terminal with solder to a terminal with a crimp connection without solder. This was incorporated to improve the water tightness of the connection.
- **Ground eyelet connection revision**  
July 2002 - A glue-lined heat-shrink sleeve was added to the ground eyelet connection of the power steering pump power supply wiring harness in order to avoid water ingress.

**WIRING CHAFING PREVENTION:**

- **Re-routing of the power steering pump wiring harness**  
April 2002 - The routing of the power steering pump wiring harness was changed to avoid chafing on the starter motor heat-shield.

**BMW'S POSITION:**

BMW stated in its PE IR response that it believes that there is an insignificant likelihood that the alleged defect will cause a fire in the subject vehicles and that the alleged defect does not pose an unreasonable risk to motor vehicle safety.

BMW noted in the PE IR response that the ground cable of the power steering pump on the subject vehicles did not have a sufficient seal at its attachment point to the vehicle chassis. This insufficient seal could result in water ingress allowing water to travel along the power steering pump power cable and come into contact with the power steering pump power cable connector. The connector could then become corroded and a result in a high thermal load condition. This could ultimately result in smoldering at the power steering pump, pump connector, and associated wiring. However, this smoldering condition is a localized event, and does not propagate.

BMW contends that it is unaware of any injuries or fatalities associated with the alleged defect. BMW also contends that there are an insignificant amount of field reports, customer complaints, and legal cases associated with the alleged defect in the subject vehicles. BMW admits that there are a very small percentage of warranty claims that are applicable to the alleged defect in the subject vehicles; however in none of those cases did the condition result in a vehicle fire. BMW stated that if the condition was actually a defect that posed an unreasonable risk, there would be a larger number of field reports, customer complaints, and legal cases. BMW contends the incidents noted in warranty claims, field reports and consumer complaints were a localized smoldering of the power steering pump connector, and the associated wiring. BMW believes that this conclusion is also supported by engineering analyses of the incidents contained in field reports and laboratory tests conducted by BMW personnel.

With regards to the effect on power steering, BMW stated that when the condition previously described in this report occurs, there is a loss of power steering assist. BMW also stated that although the loss of power steering assist is not strictly a warning to the driver of the vehicle, it is an adequate condition to “signal” to the driver that the vehicle is experiencing some type of condition that must be repaired. As has occurred in these cases, as reflected in the warranty claim history, these vehicles are brought to the dealer and repaired. BMW contends that while there is a loss of power steering capability, normal steering capability is retained and the driver maintains the ability to steer the vehicle.

### **ODI DISCUSSION:**

#### **BMW WARRANTY / CONSUMER COMPLAINT – FIRE ALLEGATIONS**

Based on the data provided to ODI during the PE and the EA, BMW identified 15 consumer reports (field reports and consumer complaints combined) where a fire was alleged due to the alleged defect. Analyzing warranty claim data verbatim text, 35 of 100 warranty claims noted the term “fire”.

Figures 3 through 5 below represent a sample of the pictures provided to ODI by BMW during the PE and the EA. All of the pictures were taken after the vehicles were alleged to have been involved in a fire due to EHPS failure. The pictures below show overheating of the wiring and the wiring connection to the EHPS. The pictures show minimal damage to components surrounding the EHPS and minimal damage to the vehicles as a whole.

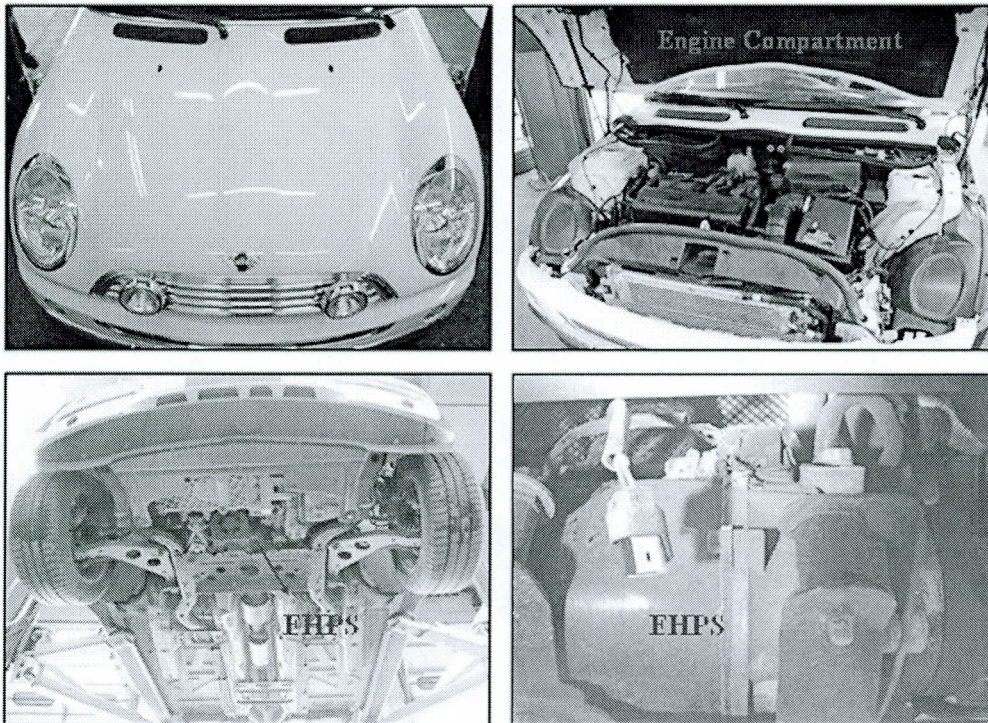


FIGURE 3

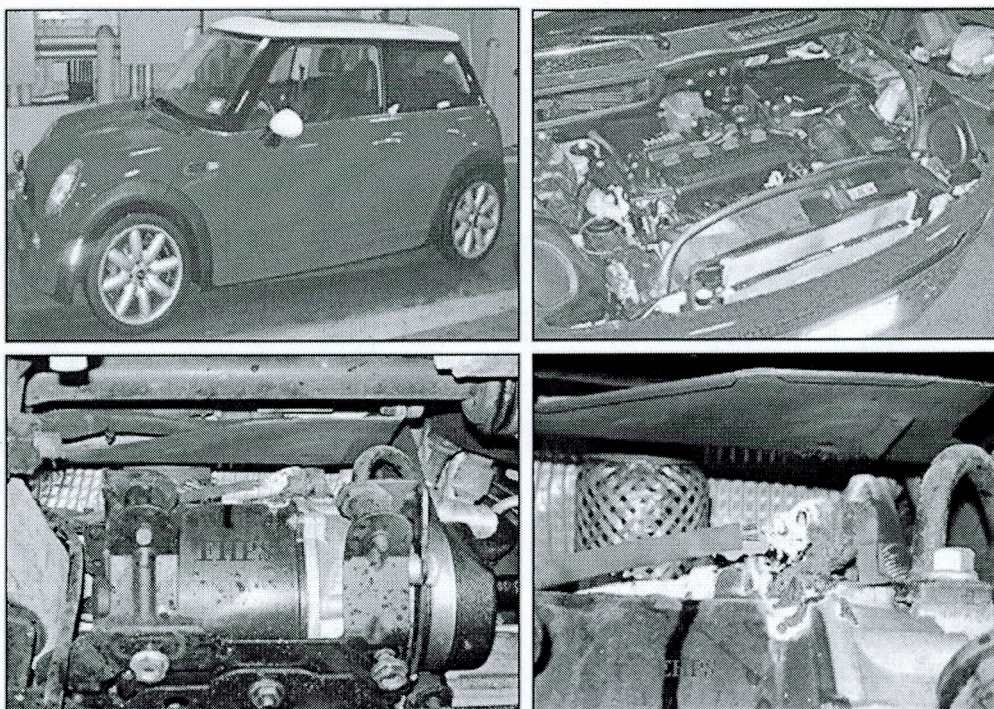


FIGURE 4

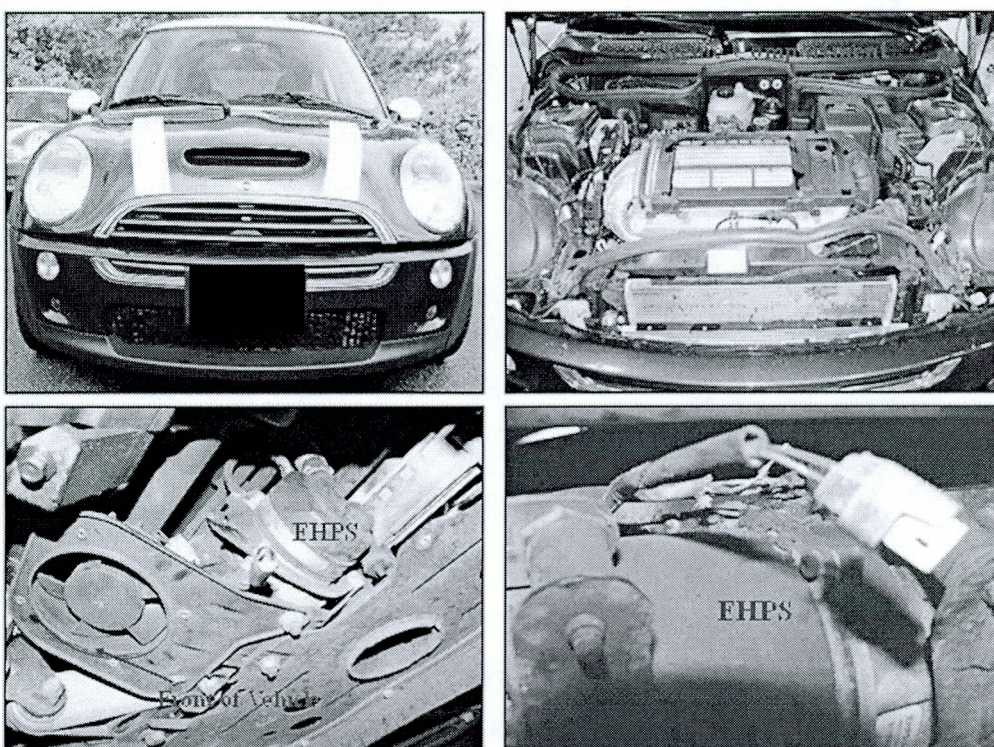


FIGURE 5

#### ODI COMPLAINTS

In total, ODI received 37 unique complaints alleging thermal failure of the EHPS system. Twenty-eight of the 30 complaints only allege a loss of power steering assist. Four of these complainants allege a loss of power steering assist and witnessing smoke emanating from the engine compartment.

**FIRE ALLEGATIONS**

During the PE and the EA, 9 consumers submitted complaints to ODI alleging a fire due to failure of the EHPS system. Five of these complainants alleged they witnessed small flames originating in the engine compartment. Two of these of complainants provided pictures of the vehicles after the alleged fires occurred (see Figure 6 and Figure 7). In both cases, there was minimal damage to the vehicles beyond the EHPS system. Four of the 5 vehicles where the complainants allege witnessing flames in the engine compartment, were repaired by replacing the EHPS system and the associated wiring. In addition to damage to the EHPS system and wiring, the fifth vehicle was alleged to have experience damage to the battery as a result of the EHPS failure. None of the complainants allege vehicle damage beyond these components.

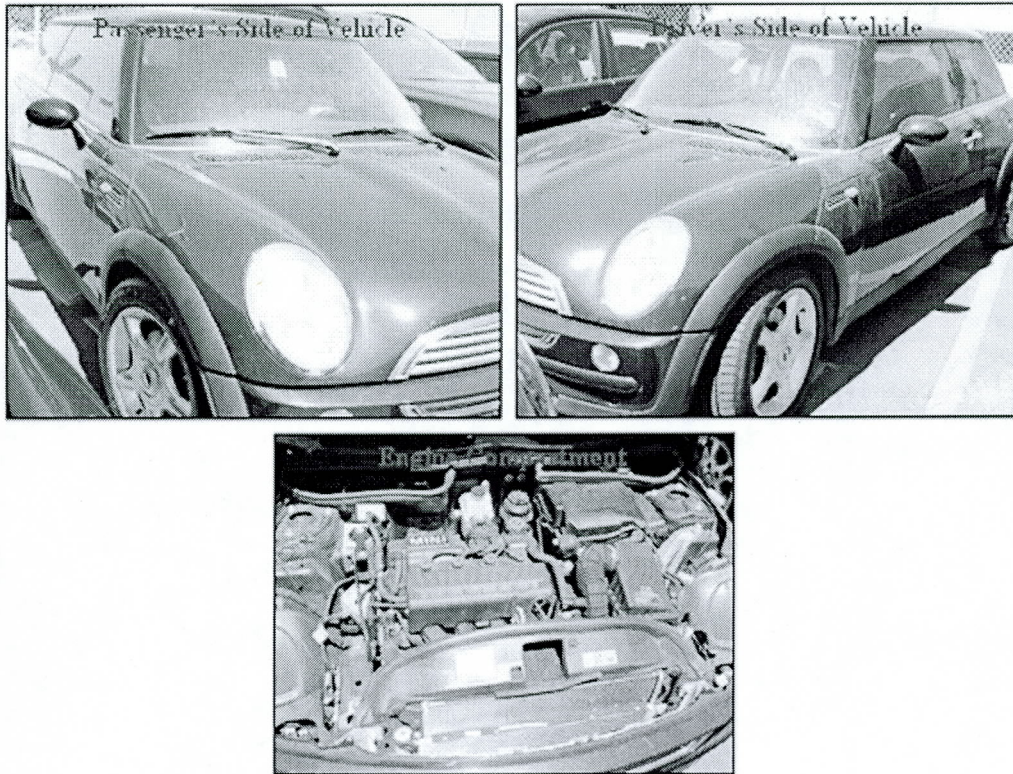


FIGURE 6

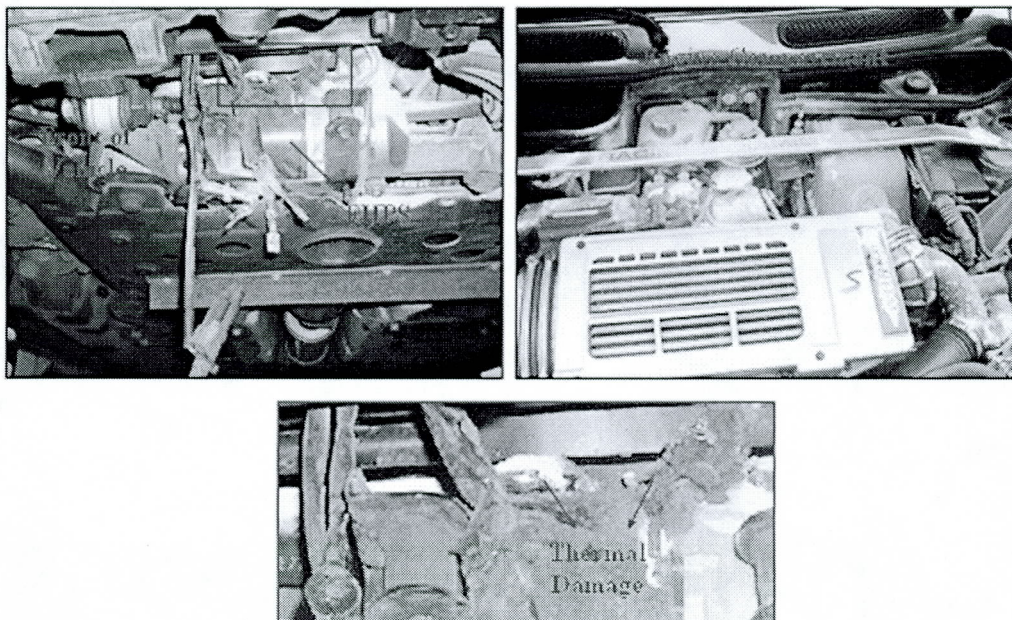


FIGURE 7

**LOSS OF POWER STEERING ASSIST ALLEGATIONS**

In BMW's IR response it stated that the alleged defect could result in a loss of power steering assist. Of the 28 ODI consumer complaints alleging a loss power steering, none of the complainants alleged the failure resulted in an accident or a complete loss of vehicle control.

Power steering assist is generally more useful to the driver at lower speeds. With respect to loss of power steering assist, 9 of the 17 complainants alleged a loss of power steering assist while driving at higher speeds ( $\geq 40$ mph). Six of the 17 complainants alleged a loss of power steering assist at lower speeds ( $<20$ mph). Four of these complainants alleged a loss of power steering and experienced difficulty while negotiating turn however, none of these complainants alleged they loss control of the vehicle or were involved in an accident. Additionally, 2 of the 17 complainants alleged becoming aware of a loss of power steering assisted while the vehicle was parked.

**DESIGN CHANGES**

ODI's analysis of warranty and complaint data provided by BMW indicates that approximately 74% of the vehicles warranty claim and 75% of the consumer complaints had manufacture dates after all the design changes that are potentially related to the alleged defect were incorporated in vehicle production. Based on field experience data and production data provided to ODI, there is an increasing warranty claim rate trend after the final design revision (July 2002) was incorporated into production until March of 2003 as represented in Chart 1 below. BMW stated that its wiring supplier's ground eyelet revision process (introduced in July of 2002) was unstable until February of 2003. Between February of 2003 and March of 2003 (and in subsequent production months) there is a drastic decline in the warranty claim rate and number of consumer complaints. Although based on the data, the design / process revisions initially appear to be largely effective in reducing consumer complaints and warranty claims; ODI has not been unable to determine that the failures have presented an unreasonable risk to motor vehicle safety. As shown in Figures 3 through 7 above, the vehicles exhibited minimal.

EA07-011 Mini Cooper

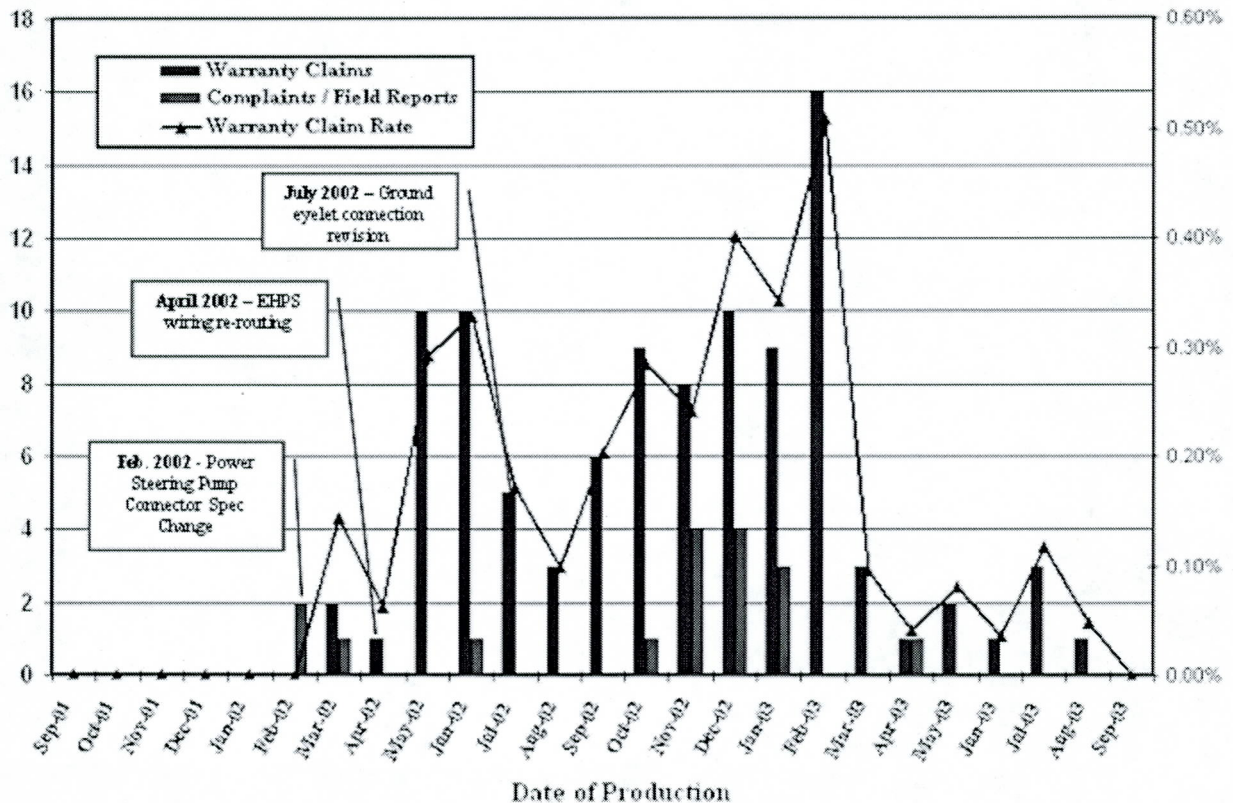


Chart 1



**REASON FOR CLOSING:**

Based on information analyzed during the investigation, ODI is unable to conclude that a safety related defect trend or an unreasonable risk to motor vehicle safety exists in the subject vehicles. Based on visual evidence provided to ODI by consumers and BMW, there is minimal damage to the vehicles beyond overheating of the EHPS wiring and wiring connectors. With regard to allegations of loss of power steering assist, ODI is unaware of any accidents or a complete loss of vehicle control attributable to the alleged defect. The closing of this investigation does not constitute a finding by NHTSA that a safety-related defect does not exist. The agency reserves the right to take further action if warranted by the circumstances.