

BMW RESPONSE
to
NHTSA PE21-021
(Follow-Up Questions and Clarifications)

October 14, 2022

INTRODUCTION

On September 12, 2022, NHTSA provided BMW with a list of follow-up questions and clarifications regarding BMW's April 1, 2022 response to PE21-021. As discussed, and agreed with NHTSA, BMW would provide its response to the information requested by the agency no later than October 14, 2022.

Accordingly, BMW has repeated each of NHTSA's follow-up questions and clarifications verbatim, and provided our written responses directly following each request. As necessary, the written information includes references to additional documentation (attachments) that are either included within this response, or were provided in our April 1, 2022 response.

REQUEST NHTSA Section I

I. Questions/Clarifications:

- 1) **The BMW IR letter furnished response states that only RP7 pumps were subject to recall, but this appears to contradict the information provided in the 'R1 production data' IR response:**

REQUEST 1(a)

- a) **Why are vehicles equipped with RP6 pumps in the subject vehicle list?**

RESPONSE 1(a)

In its April 1, 2022 response to NHTSA Question 1, BMW stated that pumps included in the recall included pumps installed as original equipment during the vehicle production process, and, as replacement equipment during a vehicle service visit, in each case, the RP7 pump. An excerpt from our response to Question 1 from the April 1, 2022 response (ref: Bates 003120-003121) is provided below. The italicized text in the excerpt below was contained in the original response in an attempt to highlight this to the agency during its review of the vehicle production data information.

*"The number of subject vehicles BMW has manufactured for sale or lease in the United States is contained in Table 1. Table 1 pertains to subject vehicles equipped with the "N47" (2.8 liter Diesel (28d)) engine and subject vehicles equipped with the "N57" (3.5 liter Diesel (35d)) engine. **BMW notes that the definition of subject vehicles pertains to vehicles within 21V-586 and, therefore, include vehicles originally manufactured with the subject component, and vehicles which received a subject component as a replacement part during a service visit.** Accordingly, subject vehicles manufactured with the subject component consist of Model Years 2017-2018, while subject vehicles receiving a subject component as a replacement part during a service visit consist of Model Years 2014-2016."*

BMW's April 1, 2022 response was based upon NHTSA's definition of "subject vehicles" and "peer vehicles" as noted in Figure 1. Recall 21V-586 consisted of vehicles originally manufactured with the RP7 pump, and vehicles which received an RP7 pump during a service visit.

BMW's April 1, 2022 response also included, in the vehicle production data file in response to NHTSA Question 1(d), the "...design version installed" during vehicle production as noted in Figure 2 which consisted of the RP7 pump or the RP6 pump, as appropriate.

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- **Subject vehicles**: all vehicles manufactured by BMW included in the NHTSA 21V-586 recall population that were manufactured for sale or lease in the United States, including, but not limited to, the District of Columbia, and current U.S. territories and possessions.
- **Peer vehicles**: all vehicles manufactured by BMW that are equipped with the subject component and that are not included in the subject vehicle population that were manufactured for sale or lease in the United States, including, but not limited to, the District of Columbia, and current U.S. territories and possessions.

Figure 1.

1. State, by model and model year, the number of subject and peer vehicles BMW has manufactured for sale or lease in the United States. Separately, for each subject and peer vehicle manufactured to date by BMW, state the following:
 - a. Vehicle identification number (VIN);
 - b. Make;
 - c. Model;
 - d. Model Year;
 - e. Subject component part number and design version installed;

Figure 2.

REQUEST 1(b)

- b) **Why are vehicles equipped with RP7 pumps in the peer vehicle list?**

RESPONSE 1(b)

BMW notes that in its April 1, 2022 response, specifically to Question 1, there were three (3) VINs in the peer vehicle list identified as pump design version RP7 which now appear to have been inadvertently included.

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REQUEST 2

- 2) **Please provide photos, diagrams, dimensions, and descriptions of all cam variants referenced in B2483. What is the difference between the ‘concave’ cam and other CP4 cam designs?**
 - a) **In reference to the 21V-586 Part 573, regarding 21V-586 recalled vehicles, which pump components introduced debris into the pump housing? What physical process caused these pump components to introduce debris into the pump housing? What caused this physical process to occur?**

RESPONSE 2

Regarding cam design, a description of the “concave symmetric” cam for the relevant US engines N47 and N57 as well as the corresponding “three harmonics symmetric” cam for B57 can be found in Attachment “CONF_BMW-kinematic-Analysis-HPP-drivetrain-EN_01_21” in Response Folder „CONF-RESPONSE-Q3\04_PLT_Root-Cause-Detection “ (ref: Bates 002481-002499).

The “three harmonics symmetric form” was developed by Bosch to fulfil the higher demands for the successor engines Bx7 in terms of torque, power, maximum fuel pressure and acoustics as described in Attachment “CONF_BMW_package_KATRI_09_19” in Response Folder “CONF-RESPONSE-Q3\04_PLT_Root-Cause-Detection” (ref: Bates 002382-002386). Simulations with the above-mentioned configurations (cam-form + RPx roller package) can be found in Attachment “CONF_BMW-kinematic-Analysis-HPP-drivetrain-EN_01_21” in Response Folder „CONF-RESPONSE-Q3\04_PLT_Root-Cause-Detection “ (ref: Bates 002481-002499), and in Attachment “CONF_AVL-simulation-calculation-drivetrain-hpp” in Response Folder “CONF-RESPONSE-Q3\05_PLT_Final-Phase” (ref: Bates 002644-002691).

Attachment “CONF_BOSCH_package_KATRI_06_21” in Response Folder “CONF-RESPONSE-Q3\05_PLT_Final-Phase” (ref: Bates 003103-003110) is demonstrating corresponding differences in starting behavior in a Bosch provocation test with severe sluggishness by coatings from highly aged bio-content.

Regarding the physical process of introducing debris (Request 2(a)), as it is strongly connected to Request 3, it is therefore treated in Response 3 below.

REQUEST 3

- 3) **Does the ‘B011417’ extended warranty include peer vehicles? If so, why were these vehicles not included in recall 21V-586? What physical process prevents or mitigates peer vehicle CP4 pump components from introducing similar debris (as produced in subject vehicle CP4 pumps) into their pump housings?**

RESPONSE 3

Extended Warranty

Yes, the extended warranty (B011417) includes peer vehicles. Peer vehicles, equipped with the RP6 pump, were not included in recall 21V-586 due to the substantially different field performance when compared to the subject vehicles, equipped with the RP7 pump. As a result, BMW believes that a recall was appropriate for vehicles equipped with an RP7 pump, while an extended warranty was appropriate for vehicles equipped with an RP6 pump.

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An excerpt from our April 1, 2022 response, specifically from the sub-section "Field observations / treatments / HPP "RP6", which was contained within the Summary section in response to Request 6, is provided below:

Field observations / treatments / HPP "RP6"

In the United States, among other markets, the HPP is regarded as an emission-relevant part and thus is subject not only to an extended warranty, but also to a special monitoring and reporting obligation. Within the scope of the field observation, in early 2017 it became apparent that the replacement rate for the HPP "RP6" in N47/N57 vehicles of model year 2014 production had exceeded the permitted reporting limit (further model years followed). Analyses of failed parts revealed in almost all cases deposits of aging products from high Biodiesel-content outside BMW specification as dominant factor.

In consultation with the CARB, since 2017 it has been successively decided to have warranty extensions (10 years / 120,000 miles) for US vehicles with N47/N57 motorization of model years 2014-2018. The basis for this approach was the evaluation that, non-starts or power reduction that could occur during driving generally occur in the perception of customers as a result of the rail pressure being too low during the engine start (starter speed).

Recall 21V-586 is focused on N47- and N57-vehicles equipped with CP4 RP7 HPP (Subject vehicles) because these pumps are dramatically more sensitive to 'out-of-spec fuel' (in US: aged Bio-Diesel content > 7%) compared to RP6 (Peer vehicles). The RP6+ pump, with a slightly higher strength roller material has a comparable behavior to the RP6 pump, especially regarding "out-of-spec fuel" conditions and, therefore, is much more robust compared to the RP7 pump.

Physical Process re Pump Debris – RP6 / RP7

In almost every case of a drivetrain failure, metal debris are a result of this failure, not a reason for the failure. Only in some very rare cases remaining debris from a previous HPP drivetrain failure may be the reason for a repeat failure, but this is in principle covered by precise repair procedures. The metal debris is a wear product from HPP drivetrain components following pre-damages due to severe sluggishness caused by 'out-of-spec' fuel components (in US primarily coatings from high content of aged Bio-Diesel).

Regarding the physical processes leading to the strongly different behavior to 'out-of-spec fuel' for RP7 and RP6, an excerpt from our April 1, 2022 response, specifically in response to Request 6(b), is provided below.

Response 6(b) The failure mechanism(s)

The BMW root cause analysis indicated an unfavorable interaction of the "RP7" package, with the specific cam shapes of the N47/N57 HDP, and in the presence of out-of-spec fuel. The "RP7" package with the main element of a larger roller (12 mm instead of 10 mm) for improvement of the hydrodynamic lubrication conditions between the roller and roller shoe can lead to sluggishness in the presence of out-of-spec fuel components due to the larger lubrication gap surface. In combination with the "sharp" N47/N57 cam shape and the greater inertia of the 12 mm roller, especially when the pump is run up to speed from an engine standstill, this can lead to increased slip between the cam and roller (see attachment „CONF_BOSCH_package_KATRI_06_21“ in folder „CONF-RESPONSE-

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Q3\03_PLT_Final-Phase". When there is preliminary damage in the form of initial "flat spots", the mentioned parts can experience material fatigue and abrasive surface wear. . The other configurations found in the US market (N47/N57 with "RP6" and B57 with "RP7") do not have the unfavorable combination and, therefore, are substantially more robust with respect to this effect.

REQUEST 4

- 4) **Regarding the 'R5 Part Sales' response, did any of the part sales include defective components? If so, how many? Additionally, what action was taken to ensure these parts were removed from equipped vehicles and the commercial market?**

RESPONSE 4

In its April 1, 2022 response to NHTSA Question 5, BMW provided the requested parts sales information as Attachment "Response-R5-Parts-Sales" in Response Folder "RESPONSE-R5-PARTS-SALES" (ref: Bates 002985). The referenced parts sales document contained a table including two parts numbers associated with the RP7 pump design, the component used in the "subject vehicles" and defined by NHTSA as a "defective component" in the context of this request. Specifically, those two part numbers were denoted as 8597819 and 8597821. As noted in our earlier response, parts sales figures represent the number (volume of units) of the respective part (i.e., part number) shipped from BMW AG to BMW NA. Specifically, for part number 8597819, the volume was 2,058 units, and for part number 8597821, the volume was 3,175 units. In both cases, those figures represent the number of units shipped from CY2017 through CY2021.

To remove RP7 pumps from the field, parts return requests were issued by BMW NA to its dealers on August 11, 2021, and on September 29, 2021, instructing dealers that parts stock should not be sold or installed on any vehicle, to remove RP7 part numbers 8597819 and 8597821 from inventory, and to return those part numbers to BMW NA.

REQUEST 5

- 5) **In reference to B2319-2322, do the tabled top row values represent kilometers or miles?**

RESPONSE 5

The top row values are in kilometers.

REQUEST 6

- 6) **The chart on B2145 is missing operating times. Please provide an updated table with operating times.**

RESPONSE 6

Attachment "B2119_CONF_HDP-Wear-Analysis-drivetrain-EN_12_19" (at B2145) in Response Folder "CONF-RESPONSE-TRANSLATIONS" contains the requested information, including two minor updates due to typographical errors within the original translation, and are self-evident on the page.

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REQUEST 7

- 7) **Please provide a detailed description of the tests described in B0393. Please include summary, drive cycle, test plan, and other relevant parameters unique to these test cycles.**

RESPONSE 7

Attachment “B0393_CONF_Q7-description-tests-EN” in Response Folder “CONF-RESPONSE-TRANSLATIONS” contains the requested information.

REQUEST NHTSA Section II

II. Abbreviations, Initialisms, Acronyms

Please provide an explanation for the following:

- **B0008: HFRR**
- **B0026: FIE**
- **B0048: CRS, SOP, BRIC, CRI-CP-CRR**
- **B0058: RB**
- **B0069: EN590**
- **B0070: MSS, MBL**
- **B0287: CRS**
- **B0810: SV**
- **B1120: Bx7TUE**
- **B2040: TWS**
- **B2168: KS, SME, SV, RSV, RDS, DRV**
- **B2169: F15/16, W10**
- **B2170: HDP**

RESPONSE II

Explanations for the acronyms are as follows:

- B0008: HFRR – High Frequency Reciprocating Rig (an indicated value for diesel lubricity)
- B0026: FIE – Fuel Injection Equipment (includes the high pressure pump, rail, and injectors)
- B0048: CRS, SOP, BRIC, CRI-CP-CRR
 - CRS – Common-Rail System
 - SOP – Start of Production
 - BRIC – Brazil Russia India China
 - CRI – Common-Rail Injector
 - CP – Common-Rail Pump
 - CRR – Common-Rail Rail
- B0058: RB – Robert Bosch
- B0069: EN590 – European norm for diesel fuel
- B0070: MSS, MBL
 - MSS – Motor Start Stop (engine with an automatic stop and start system)
 - MBL – “MengenBiLanz” (calculation of the fuel balance of a common-rail system)

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- B0287: CRS – Common-Rail System
- B0810: SV – “SaugVentil” (suction valve, the inlet valve in the high pressure pump)
- B1120: Bx7TUE – reference for engine type/generation/configuration/etc.
 - B: B engine generation
 - x: (4 = 4-cyl), (5 = 6-cyl)
 - 7: diesel engine
 - TUE: update of engine generation
- B2040: TWS – “TriebWerk Schaden” (drivetrain damage of the high pressure pump)
- B2168: KS, SME, SV, RSV, RDS, DRV
 - KS – “KraftStoff” (fuel system)
 - SME (ZME) – “ZuMessEinheit” (metering unit on the high pressure pump)
 - SV – “SaugVentil” (suction valve, the inlet valve in the high pressure pump)
 - RSV – “RueckSchlag Ventil” (back-pressure valve, the outlet valve in the high pressure pump)
 - RDS – “RailDruckSensor” (rail pressure sensor on the rail)
 - DRV – “Druck Rege/Ventil” (pressure regulation valve on the rail)
- B2169: F15/16, W10
 - F15/16 – reference for vehicle type X5/X6
 - W10 – reference for vehicle assembly plant Spartanburg
- B2170: HDP – “HochDruckPumpe” (high pressure pump)

REQUEST NHTSA Section III

III. Translations

The following were found in the English translated documents and were not translated from their native language

- **B0073: Chart is in German**
- **B0280-0284**
- **B0422-0423**
- **B0946: Diagram is in German**
- **B1349**
- **B1389-1390**
- **B2085-2086**
- **B2119-2148: All figures and plots need to be translated.**
- **B2238-2240**
- **B2316-2317**
- **B2485, 2486, 2491, 2499: Charts are in German**
- **B2714-2715**
- **B2789-2792**
- **B2836, 2838, 2840, 2842, 2844**

RESPONSE III

Response Folder “CONF-RESPONSE-TRANSLATIONS” contains the requested information. Within the folder are separate and updated documents that contain translations for the referenced pages.