

December 2, 2022

## **Hitachi Cable America Consulting**

### **Addendum to Supplemental Technical Report in Support of Hitachi Cable America, Inc. Amended Petition for Inconsequential Noncompliance—FMVSS 106, Brake Hoses**

1. On November 10, 2022, on behalf of Hitachi Cable America, Inc. (HCA) Covington and Burling LLP submitted to the National Highway and Traffic Safety Administration (NHTSA) a Supplemental Petition for Determination of Inconsequential Noncompliance (the “Supplemental Petition”).<sup>1</sup> Attached to the Supplemental Petition was an Exponent Report titled “Technical Report in Support of Hitachi Cable America, Inc. Amended Petition for Inconsequential Noncompliance—FMVSS 106, Brake Hoses” of the same date (the “Supplemental Technical Report”). Exponent’s Supplemental Technical Report summarized safety test results completed up to the date of the report and indicated that some past production accelerated durability stroke testing was ongoing.<sup>2</sup> This Addendum summarized the completed safety testing described in the Supplemental Petition.
2. The completed testing does not alter Exponent’s observations and conclusions in the Supplemental Technical Report, or in its technical report filed in connection with HCA’s initial Petition for Determination of Inconsequential Noncompliance filed on August 19, 2022 (the “Initial Petition”). The test results were comparable to results of prior testing; no damage to the hose assembly or leakage was seen on the samples tested after November 10, 2022. Exponent’s conclusion remains that the Nylon and PVC brake hose assemblies do not present an incremental risk to motor vehicle safety over the useful lifetime of the motorcycles
3. The below sections from the Supplemental Technical Report have been amended to incorporate the results of each of the additional tested samples.

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<sup>1</sup> In re: 22E-061, Brake Hose Assemblies – Hitachi Cable America, Inc.’s Supplemental Petition for Determination of Inconsequential Noncompliance. November 10, 2022.

<sup>2</sup> Exponent, Inc. “Technical Report in Support of Hitachi Cable America, Inc. Amended Petition for inconsequential Noncompliance—FMVSS 106, Brake Hoses”, November 10, 2022.

## Amendment to Past Production Nylon Test Results

### 2.6.3 Accelerated Durability Suspension Stroke Testing Following Water Absorption

4. Exponent sampled 24 past production front suspension nylon brake hose assemblies (distribution shown infra) from inventory for accelerated durability suspension stroke testing. Additionally, similar to the nylon hose assembly testing presented in Exponent's Initial Technical Report,<sup>3</sup> HCA fabricated six custom nylon hose assemblies for testing on the HML suspension stroke test fixture.<sup>4</sup>
  - a. Four nylon brake hose assemblies from March 2019 production stock
  - b. One nylon brake hose assembly from June 2020 production stock
  - c. Three nylon brake hose assemblies from August 2020 production stock
  - d. Four nylon brake hose assemblies from December 2021 production stock
  - e. Twelve nylon brake hose assemblies from April 2022 production stock
  - f. Six custom fabricated hose assemblies from Hitachi Cable Querétaro (HCQ) manufacturing facility
5. Prior to accelerated durability suspension stroke testing, the brake hose assemblies were subjected to Water Absorption conditioning according to FMVSS 106 S5.3.7. The custom fabricated hose assemblies were tested at HML's facility in Japan, and the past production hose assemblies were tested in Exponent's laboratory.
6. Twenty-four nylon brake hose assemblies from inventory and six custom fabricated hose assemblies have been tested. Each of the 30 hose assemblies tested completed the testing without any leakage or damage to the hose assembly during the accelerated durability suspension stroke testing (300,000 suspension stroke cycles at 500 psi pressure).
7. Subsequently, the samples were subjected to leak and burst testing. Exponent made the following observations:

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<sup>3</sup> Initial Technical Report, Section 4.5.1.4.

<sup>4</sup> These hose assemblies were the same dimension (hose free length) as the PVC hose assemblies and were connected to the same manifold. However, the hose and end fittings (i.e., nipple, crimp socket, pre-crimp, crimp) are production baseline nylon hose assembly design. Therefore, the hose and end fittings subject to the accelerated durability suspension travel are representative of the production baseline nylon hose assemblies, even though the specific test hose assembly is not a production part (i.e., it does not correspond to a specific part number); instead, it is a custom fabricated part to fit the test fixture and facilitate study of the fatigue properties of the past production nylon hose assembly stock.

- a. None of the custom nylon hose assemblies demonstrated leakage during the leak and burst testing (500 psi five-minute hold, 1,000 psi 30-second hold, 4,000 psi two-minute hold, or below 5,000 psi).
  - b. The twenty-four tested nylon hose assemblies did not leak during the leak and burst testing (500 psi five-minute hold, 1,000 psi 30-second hold, 4,000 psi two-minute hold, or below 5,000 psi).
  - c. All of the tested nylon hose assemblies passed the FMVSS 106 Burst Strength requirement.
  - d. Each of the tested hose assemblies exceeded the FMVSS 106 S6.2 Burst strength test requirement. Burst strength ranged from 11,336 to 15,916 psi with an average burst strength approximately 13,687 psi.
  - e. Each of the tested nylon hose assemblies satisfied the FMVSS 106 Burst Strength requirement.
8. The complete test results are found in Attachment 5: *Past Production Nylon Water Absorption Accelerated Durability Suspension Stroke Testing\_Rev* spreadsheet.

## Amendment to Past Production PVC Test Results

### 3.4.1 Accelerated Durability Suspension Stroke Testing

9. Exponent sampled 156 past production PVC hose assemblies (distribution shown in Table 6) from inventory for accelerated durability suspension stroke testing.

**Table 6. Distribution of past production PVC brake hose assemblies sampled for accelerated durability suspension stroke testing.**

Past Production PVC Brake Hose Assemblies Sampled for Accelerated Durability Stroke Suspension Testing															
Month	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
January											1				
February			4							4					8
March							8					4			8
April									4						
May	8		4	4					4	4					
June	4					8	4					4	1		
July						8						2			
August										3				4	
September						4	7	4							
October									4					28	
November		4						1			1				
December															
<b>Total Per Year</b>	<b>12</b>	<b>4</b>	<b>8</b>	<b>4</b>		<b>20</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>1</b>	<b>10</b>	<b>33</b>		<b>16</b>
<b>Total</b>	<b>156</b>														

10. All 156 hose assemblies completed the 300,000 suspension stroke cycles without leakage or hose damage. The hose assemblies were generally tested beyond the 300,000 cycle requirement; seven hose assemblies were subject to 511,365 cycles. After accelerated durability suspension stroke testing, the hose assemblies were subject to leak and burst testing and the following was observed:
  - a. No leakage was observed during the 500 psi five-minute and 1,000 psi 30-second hold.
  - b. No leakage was observed during the 4,000 psi two-minute hold.
  - c. No leakage was observed at or below 5,000 psi pressure.
  - d. Each of the tested hose assemblies exceeded the FMVSS 106 S6.2 Burst strength test requirement. Burst strength ranged from 13,313 to 18,220 psi with an average burst strength approximately 16,718 psi. For some of the hose assemblies, the banjo washer yielded at >14,547 psi without rupture of the brake hose assembly, in this case the washer yield load was taken as the hose assembly burst strength.
11. The complete test results are found in Attachment 6: *Past Production PVC Accelerated Durability Suspension Stroke Testing\_Rev* spreadsheet.

### 3.4.2 Accelerated Durability Suspension Stroke Testing Following Water Absorption

12. Exponent sampled 72 past production PVC hose assemblies (distribution shown in Table 7) from inventory for accelerated durability suspension stroke testing following water absorption.

**Table 7. Distribution of past production PVC brake hose assemblies sampled for accelerated durability suspension stroke testing following water absorption.**

Past Production PVC Brake Hose Assemblies Sampled for Accelerated Durability Stroke Suspension Testing Following Water Absorption															
Month	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
January											1				
February			4							4					4
March															
April															
May			4	4											
June	4					8						4	1		
July						8						2			
August															
September						4									
October									4				12		
November		4													
December															
<b>Total Per Year</b>	<b>4</b>	<b>4</b>	<b>8</b>	<b>4</b>		<b>20</b>			<b>4</b>	<b>4</b>	<b>1</b>	<b>6</b>	<b>13</b>		<b>4</b>
<b>Total</b>	<b>72</b>														

13. All 72 hose assemblies completed the 300,000 suspension stroke cycles without leakage or hose damage. The hose assemblies were generally tested beyond the 300,000 cycle requirement, eight hose assemblies were subject to 473,585 cycles. After accelerated durability suspension stroke testing, the hose assemblies were subject to leak and burst testing and the following was observed:
- No leakage was observed during the 500 psi five-minute and 1,000 psi 30-second hold.
  - No leakage was observed during the 4,000 psi two-minute hold.
  - No leakage was observed at or below 5,000 psi pressure.
  - Each of the tested hose assemblies exceeded the FMVSS 106 Burst Strength requirement. Burst strength ranged from 12,431 to 18,249 psi with an average burst strength approximately 16,536 psi.

The complete test results are found in Attachment 7: *Past Production PVC Water Absorption Accelerated Durability Suspension Stroke Testing\_Rev* spreadsheet.

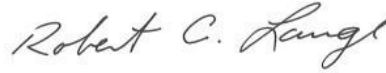
November 17, 2022

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Sincerely,



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*This test report describes testing of brake hose assemblies performed at the request of Hitachi Cable America Inc. (“HCA”). Exponent, Inc. (herein “Exponent”) has performed testing described in this report using HCA equipment installed at the HCA facility in New Albany, Indiana. Exponent guided testing at Hitachi Metals Ltd. (“HML”) in Japan and reviewed test reports received from on-site engineers. Exponent also reviewed test reports from third-party test laboratories Element Materials Technology test laboratories in Des Moines, Iowa; a National Highway Traffic Safety Administration (NHTSA) compliance test laboratory. Exponent reserves the right to supplement this report and modify conclusions based on a review of additional materials as they may become available. The findings presented herein are made to a reasonable degree of engineering certainty. This report and its contents shall be considered, forwarded, reproduced, and/or otherwise handled only as an entire document such that no findings or conclusions are taken out of context or are removed from the associated assumptions and/or limitations.*