Survival Factors Factual Report Attachment 1

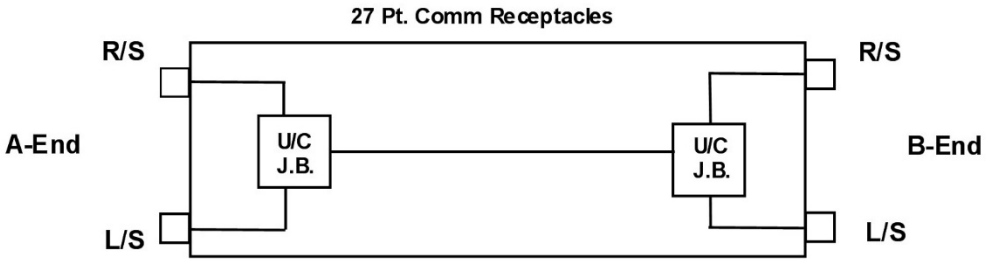
Railroad:	National Railroad Passenger Corporation (Amtrak)
Train	Train 89
Location:	Chester, Pennsylvania
Date:	April 3, 2016
Number:	DCA16FR007

Car 82524 – Train 89 – Investigation

On Thursday, May 19th, an investigation of Amfleet I Coach Car 82524 was conducted at Amtrak's Bear Car Shop at Bear, DE. The test was witnessed by Dana Sanzo of the NTSB, and Pete Lapre of the FRA. Assisting with the test equipment were Amtrak Technicians James Mort and Phil Barowski. The equipment used was an automated trainline tester manufactured by CableTest Systems of Markham, Ontario, Canada. It is more commonly referred to as the MPT1000, multi-point tester.

The MPT tester conducts a programmed series of tests on 27 Pt Comm & MU, as well as 480V trainlines. Thursday's test was limited to the COMM trainlines only. The MPT does run a 3-part test of Continuity, Insulation and Hi-Pot. Our focus is mainly limited to the continuity of the COMM trainlines, and can be viewed in the attached test report.

The complete 27 Pt Comm trainlines can be seen in the test results from line 50 to line 116. Each trainline is repeated three times because they are tested in three segments: A-end left to right, A-end to B-end, and B-end left to right. This sequence can be better visualized with the basic illustration shown below.



Our main focus were the three pairs of trainlines that carry Voice (T/L 3 & 4), Intercom (T/L 5 & 6), and Control (T/L 7 & 8). A fourth pair of trainlines became an issue later into the investigation. They are Radio (T/L 9 & 10), but are no longer used in normal revenue service. See drawing D-04-414, Sheet 4, attached.

The MPT tester has been programmed to measure trainline continuity at 10 Ohms or less. This criteria can be seen on the attached document, "MPT Tester – Pass Fail Criteria". Lines 57 through 74 of the MPT test report, show the results for trainlines 3, 4, 5, 6, 7 and 8. These lines all measured less than 10 Ohms, and are considered passing. Lines 75 through 80 of the test report show the results of trainlines 9 & 10. The 31.4 Ohm reading on Line 75 was not rejected because of the obsolete nature of the trainline.

Lines 172 and 174 of the test report caused the overall test to fail because results for all Hi-pot testing on an Overhaul line such as Bear Shop must read at least 25 Megohms. The results are still good for a PM line, and are no cause for concern.

After the MPT test was complete, we moved on to the testing of the PA trainlines from the PA enclosure to the undercar junction box. We first tried to use the relatively new PA trainline tester, as shown in the photo below.

Photo – PA Trainline Tester

But, the combination of burned and disfigured pins at the PA shoe, did not allow the tester to work properly. To work around this problem, we performed a line-by-line continuity check from the trainline receptacle to the PA enclosure. This portion of the investigation revealed the issue of the incorrectly wired trainlines. The Voice output of the PA (T/L 3 & 4) was swapped with the Radio output of the PA (T/L 9 & 10). This is visually explained by examining marked-up schematic diagram D-04-414, Sheet 22 (attached).

The afternoon session continued at Amtrak's Wilmington Electric Shop. The PA unit from car 82524 was functionally tested at the bench by Technician Steve Keough. The local amplifier, Intercom function, and all trainline features were functioning properly. More in depth, resistance readings were taken, and all readings were normal.

We were able to conclude, that the PA unit, if not dislodged from its enclosure would have worked properly. But, the miswired trainlines found on car 82524 prevented proper operation of the PA unit.

Car 82524 will remain at Bear Car Shop for further investigation.

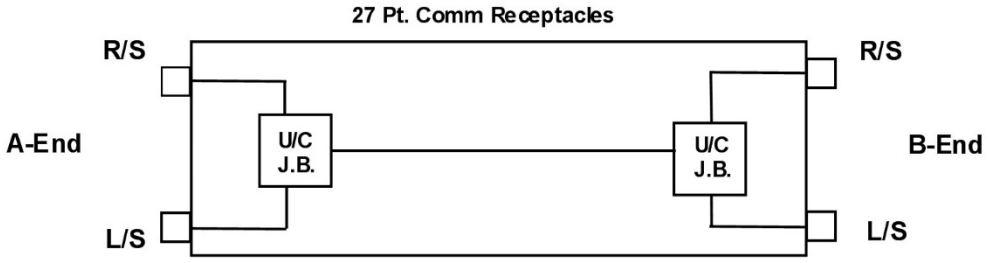
Car 82993 – Train 89 – Investigation

TESTING

On Thursday, June 2nd, an investigation of Amfleet I Coach Car 82993 was conducted at Amtrak's Bear Car Shop at Bear, DE. The test was witnessed by Dana Sanzo of the NTSB, and Pete Lapre of the FRA. Assisting with the test equipment was Technician Tom Rapposelli. The equipment used was the MPT1000, as was used on previous car 82524. Also used was the PA Trainline Tester, to check PA trainlines from the PA enclosure to the undercar junction box. (See Photo, below)

Photo – PA Trainline Tester

A scan of the MPT test results is attached to the email. The most relevant lines of the test results are Lines 57 through 80. These represent COMM trainlines 3 to 10 which carry the signals into and out of the PA. As discussed in the previous report, the MPT tester tests each trainline in three parts: A-end left to right, A-end to B-end, and B-end left to right. The sequence is visualized in the illustration below:



The MPT tester has been programmed to measure trainline continuity at 10 Ohms or less, and test report Lines 57 – 80 meet that criteria. After good continuity through the car was verified, the PA tester was inserted into the PA shoe. Resistance readings were then taken at the B-end, left and right side COMM receptacles. The numbers indicated that the trainlines running from the PA enclosure to the undercar junction box were intact, and wired correctly. Please reference drawings "PA Trainline Tester" and 020-XXXXX for more information.

The 480 Volt trainlines could not be tested due to the damaged plugs on the A-end of the car. See photos below.


Photos – Damaged 480 Volt Trainline Plug on A-end of Car 82993

The afternoon session continued at Amtrak's Wilmington Electric Shop. The Safetran PA unit from car 82993 was functionally tested at the bench by Technician Steve Keough. Local amplifier, Intercom Function, Control and all Trainline features were working properly. Resistance readings of the PA unit were normal. Mr. Keough reported the current reading of the amplifier was slightly high, but was no cause for alarm. He also reported that not all functions were operating initially, but cleaning of the PA plug alleviated the problem.

TESTING – UTE PA

It was noted that during the course of the PA test, that the UTE (Ultra-Tech) PA unit from car 25034 was sent to Amtrak's Hialeah Shop. Currently, that is the only location that has a bench top UTE PA tester. There are some future plans to get more UTE bench top PA testers at other locations, such as Ivy City in Washington, Sunnyside Yard in Queens, NY and the Wilmington Electric Shop. The test procedure for this PA is attached to the email.

POWER DISTRIBUTION in an AMFLEET PASSENGER CAR

While at the Electric Shop, Ms. Sanzo reiterated her interest in the power distribution system of the Amfleet car. Basically, it is as follows:

480 Volt, 3-phase, 60Hz power is generated by the locomotive, and carried to the first car in the train by four, 400 Amp jumpers. Identical jumpers at the other end of the car pass power to the rest of the train.

Photo – 480V Trainline Plug and Receptacle

Inside the vehicle, the four paths converge from each end, and meet approximately in the center of the undercarriage at the 480V trainline box. From there, power is sent to the undercar 480V circuit breaker box. (See drawing D-04-414, Sheet 3). 480 Volt power is used for high-power items such as air conditioning, and floor heating. There are two, 3-phase transformer banks. The 480/240Vac bank is used for cove lighting and bathroom water heaters (See drawing D-04-414 Sheet 5 & 8). The 480/120Vac bank is mainly used for convenience outlets and auxiliary heaters. There is also a 120/28Vac transformer used strictly for reading lights (See D-04-414 Sheet 6).

The DC system consists of a 480Vac/74Vdc Low Voltage Power Supply (LVPS)/Battery Charger. The battery charger is connected to the batteries and the DC loads. When 480 Volt power is lost, the DC loads are automatically maintained without any switching involved. The DC loads are divided into two groups: the primary bus and the secondary or load shed bus. When the car is off power for an extended period of time battery voltage will become depleted. When battery voltage reaches 56Vdc, the load shed relay de-energizes, and drops out all DC loads except the PA and emergency lighting, to preserve what little battery capacity is left (See D-04-414 Sheet 16).