Trip Report - Brookville ex-SEPTA PCC Overhaul, May 2016

Update

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1. Introduction

Joseph Flores and Kevin Sheridan visited Brookville Equipment Co. in Brookville PA, May 2 through May 5, 2016. The purpose of our visit was to inspect the progress of the four ex-SEPTA PCC cars currently going through overhaul.

1.1 Overview

The PCC overhaul fleet consisted of four vehicles. The following is the status of the overhaul pool. At the time of our visit, Car #5 was just scheduled to be sent. SF MUNI car number is still to be determined.

1. Car #1 - #1056 – Undercar wiring is underway and nearing completion. Poles are installed on the roof. Interior wiring and interior paneling installation is underway.

2. Car #2 - #1051 – Primer is completed. Minor bodywork changes being added. Will be moving to paint shop shortly.

3. Car #3 - #1060 - Body repair is nearly completed. Minor bracket work is nearing completion and the floor is being finalized.

4. Car #4 - #1059 – Body repair is underway. Sides have been removed and interior structural metal is being replaced/repaired.

5. Car #5 – TBD

2. Car Overhaul Details

2.1 Car #1 - #1056

Body repair and all major metal work has been completed on this car. Primer has been applied and the underbody, interior, and portions of the exterior have received a layer of basecoat. Undercar wiring is underway and is nearly completed. Interior wiring is underway, with interior panels being staged for installation. A large portion of our time was devoted to inspecting the current wiring design and quality and to provide input for potential changes to enhance reliability and ease of maintenance.

2.1.1 Contactor Panel Enclosure

Wiring of the components in this enclosure was completed, with labeling and QA checks being conducted. After the first inspection of the enclosure, several points were brought up regarding the current layout of the wiring.

The position of the Limit Relay and connected wiring makes access to the Contactor Panel difficult. Upon discussion with Brookville staff, potential solutions include modified connectors or relocation of the limit relay. Modified connectors would allow the wire runs to come off of the Limit Relay at a 90

degree angle, which limits the intrusion of the wiring into the free space and the Contactor Panel. This connector could either be sourced from Bombardier or a manufactured by Brookville. Relocation of the Limit Relay would move the potential obstruction toward the end of the enclosure, but clearance issues may still exist.

One suggestion was to connectorize the limit relay for easier maintenance. The Limit Relay Board is often removed and placed on a work bench for service. The current setup consists of a typical bundle of wires and terminal lugs. Replacing the bundle of leads will simplify removal and installation and ensure integrity of connections. This suggestion applies only to the leads to the Limit Relay Board, and not the Series Coil wiring.

Figure 1 – Limit Relay Board

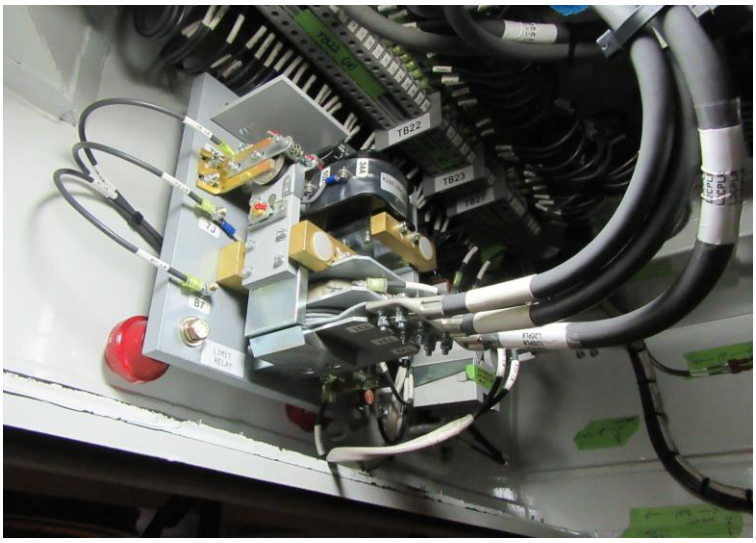
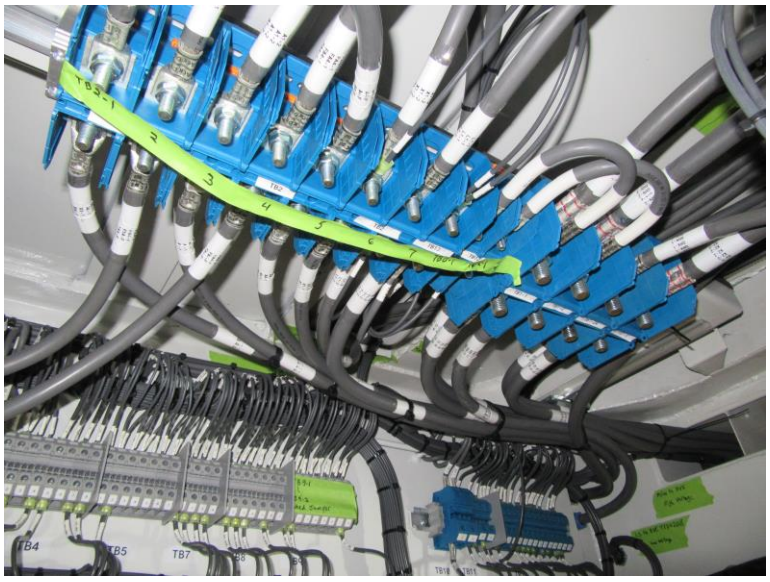


Figure 2 – Contactor Panel Enclosure Layout

Terminal blocks were installed throughout the rebuilt car, including in the Hi-Voltage Enclosure. Some of the wiring runs were longer than usual, which brought up vibration and chafing concerns. Brookville suggested that the installation of additional tie bars would help alleviate any potential vibration and fitment issues.

Figure 3 - High Voltage Enclosure Terminal Block



2.1.2 Master Controller and Foot Pedal Enclosure

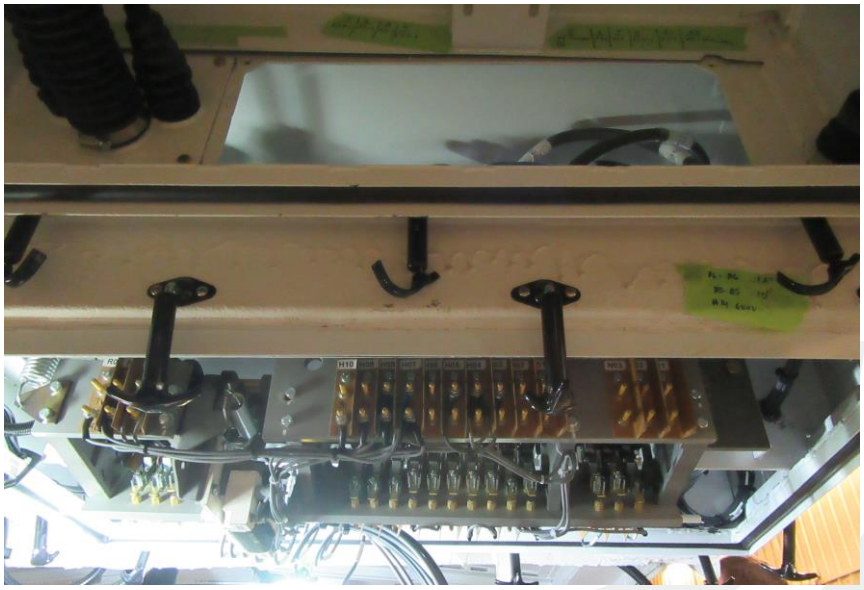
The Master Controller compartment was rebuilt and moved toward the front section of the car. Wiring of the Master Controller was nearly completed, and the Foot Pedal Assembly was installed. The Deadman Switch Assembly was mounted in the enclosure for mock-up purposes during our visit. Installation is pending. Head clearance is good within the enclosure. The provided openings will allow for ease of servicing. Potential interference with life guard basket is anticipated, but this can be worked around.

Figure 4 – Foot Pedal and Deadman Switch Assembly

Figure 5 – Headspace in the Foot Pedal compartment

Some of the wiring around the Master Controller were lengthy. Brookville once again suggested that the installation of additional tie bars would help alleviate any potential vibration and fitment issues.

Figure 6 – Master Controller



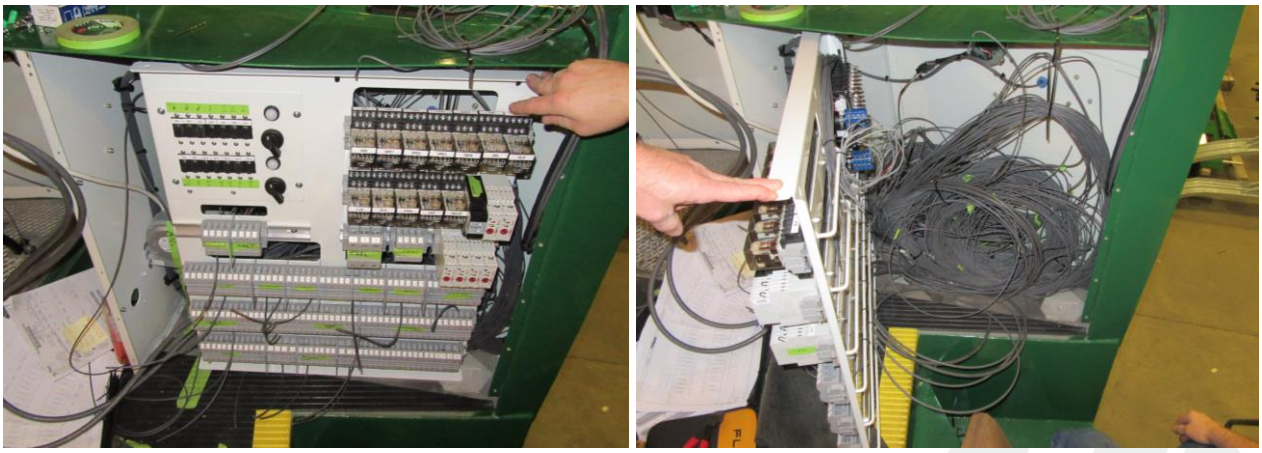
2.1.3 Interior Wiring

Electrical wiring in the Interior is on-going. Wire and conduit has been run through the ceiling and side walls and some paneling has been installed.

Figure 7 – Interior Wiring View

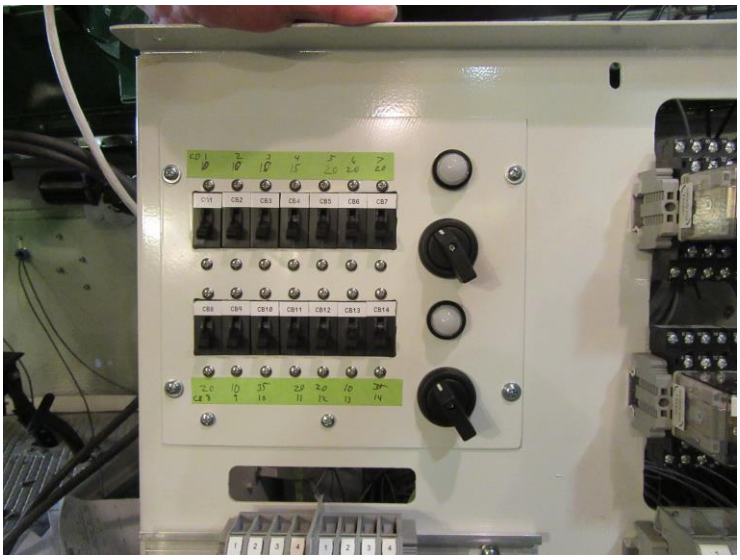
Brookville advised that they planned on installing a swingout front panel for the Underdash Electrical Panel. This feature would ease replacement of any items on the panel, in addition to the components behind the panel such as the wiper motor and heater ducting.

Figure 8 – Underdash Electrical Panel



The swingout panel also feature a removable panel for access to circuit breakers, door bypass, and blower bypass switches and indicator lights. This will facilitate maintenance activities, since these items are replaced more often than other parts located on this panel.

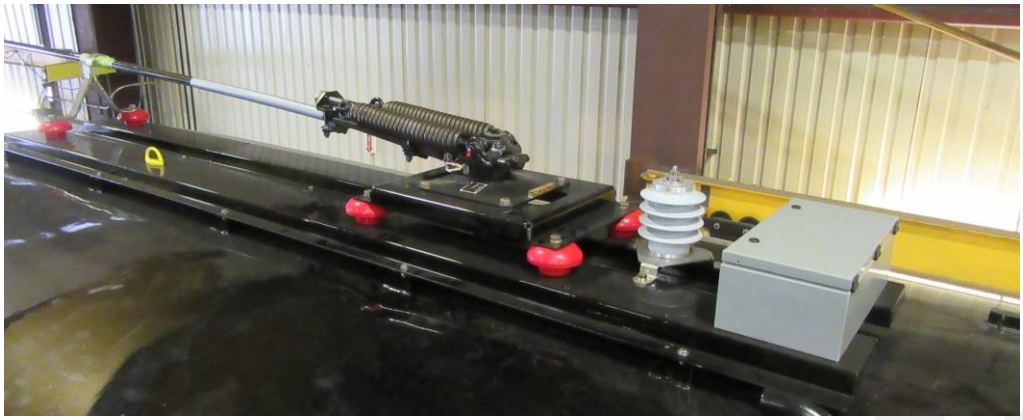
Figure 9 - Underdash Electrical Panel Removal Panel



2.1.4 Trolley Pole

The trolley pole and base are both installed on the roof. The trolleyboard is now constructed of metal, with red insulators observed. Roof grit will be applied after final painting.

Figure 10 - Trolley Pole



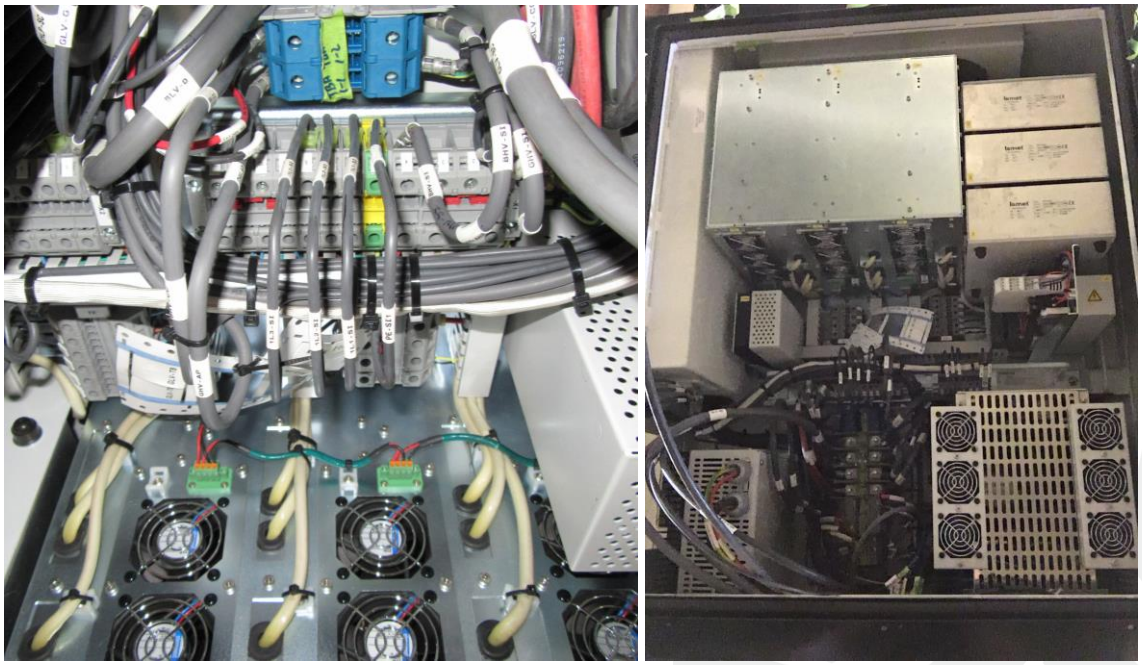
The interior roof was reinforced with additional metal bars adjacent to the carlins to prevent excessive flexion and cracking.

Figure 11 – Ceiling reinforcement

2.1.5 LVPS

Wiring of the components in this enclosure was completed, with labeling and QA checks being conducted.

Figure 12 – LVPS Wiring



The LVPS enclosure features a new access panel to the rear of box for circuit breakers and overload trips. This panel allows access without the need to drop the bottom pan. This can be useful when dealing with any electrical issues during road calls.

Figure 13 – LVPS Access Panel

Two fans are now installed on the LVPS enclosure to provide greater airflow to address overheating concerns.

Figure 14 – Ventilation Fans

Connectorized leads were added to the LVPS Enclosure to allow for easier removal and servicing.

Figure 15 – Connectorized LVPS Enclosure Electrical Connections

The Filter Cover was redesigned to allow drop in replacement of the filter. However, there is a potential filter cover clearance issue with the side skirt. There is just enough room to allow the filter to be changed, but the fasteners are currently configured to require a tool for opening and closing. This issue was discussed with Brookville, and the idea of using a fastener that doesn't require any tool was brought up.

Figure 16 – LVPS Filter Cover

2.1.6 Propulsion Blowers

The Pressure switch has been relocated to a position inside of the enclosure, where it's protected from elements and dirt. Another potential benefit is a better pressure signal since the sensor is now closer to the fan ducting.

Figure 17 – Propulsion Blower Pressure Switch

2.2 Car #2 - #1051

Body repair and all major metal work has been completed on this car. Primer has been applied and the car has been leak tested. Minor leaks were found during this test and have been repaired. Minor metal working is being done based on findings from Car #1. This work includes the addition of bracketing for wiring and modifications to the Rear Teardrop window to ease window installation.

Figure 18 – #1051 Overall View

Figure 19 – Repaired Leak

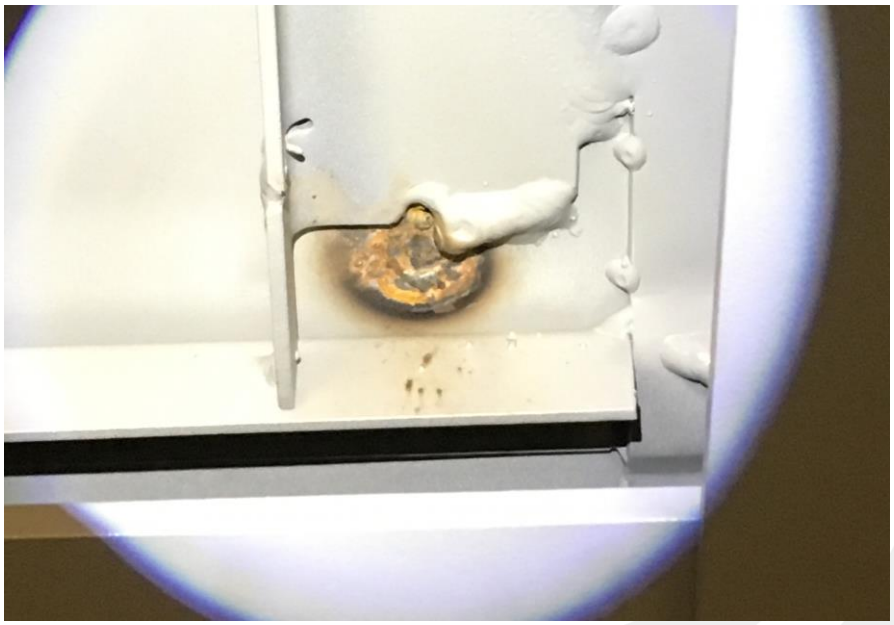


Figure 20 – Rear Teardrop Window Modification

2.3 Car #3 - #1060

Body repair metal work is nearly completed on this car, with work on the floor progressing.

Figure 21 – #1060 Overall View

Figure 9 – #1060 Floor

2.4 Car #4 - #1059

Body repair metal work is progressing. The roof and side panels have been removed, and work is underway to replace the lower portions of the side, including the side rails and the lower portion of the posts that connect the side walls to the floor.

Figure 22 – Side Wall Post Bottoms Replaced

These side posts appeared to have been replaced during the previous overhaul done by Morrison Knudsen, and appear to have deteriorated prematurely.

Figure 23 – Side Wall Post Bottoms Replaced

Crash damage was found that Brookville states wasn't previously indicated. The entire lower Front section ahead of front door portal, including front spine and nose, were all replaced.

Figure 24 – Front End Replaced

3. Other Items

3.1 Truck Rebuild

Trucks are being rebuilt at Brookville's shop facilities located close to downtown Brookville. The first truck is currently assembled and is awaiting the installation of the traction motors and track brakes. These trucks were observed to have the Vulcanite rubber sandwiches installed on the wheels, not the Lord blocks which were previously noted to be installed.

Figure 25 – Rebuilt B2 Truck

The rebuilt trucks will feature a new terminal block, which will allow the wiring to the Track and Shaft brakes to be easily disconnected from the main carbody when the truck is dropped.

Figure 26 – Location of Track/Shaft brake Terminal Block

3.2 Track Brakes

The Union track brakes were not yet installed on the trucks at the time of our visit.

Figure 27 – Union Track Brake

3.3 Doors

Door System manufacture and final design is ongoing. Manufacture of the door motor header plates and linkages was occurring during our visit. We discussed our experiences with system components during our ongoing Rotary Door drive retrofit, particularly with the door motor cam, linkage, and pivot arms. We also discussed the current configuration of the door chime alarm, in particular the operation when the doors are closed but sensitive edge is activated. It was suggested that the wiring be modified to match the current configuration, which consists of the alarm sounding when the sensitive edge is activated when the door is closed.

Figure 28 – Rear Door Relay Panel

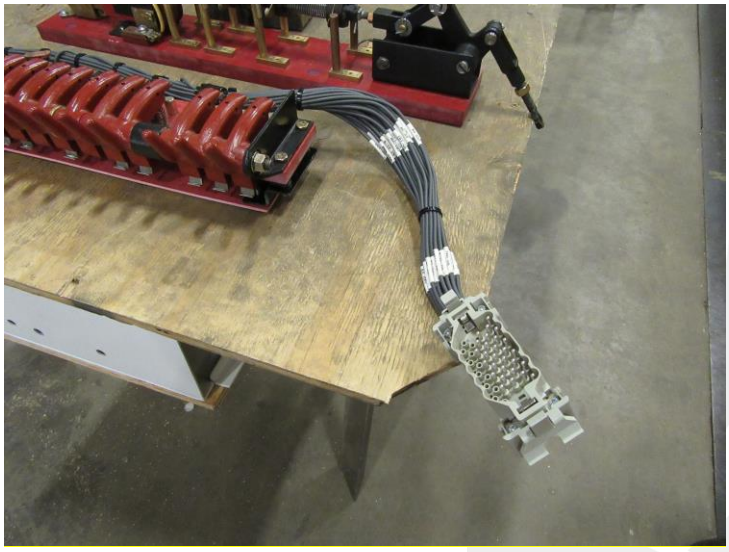
The plymetal doors were waiting to be manufactured, with the plymetal material prestaged on the shop floor.

Figure 29 – Plymetal Board Material

3.4 Gang Switch Assembly

The Gang Switch Assembly has been rebuilt and is ready for installation. The whole unit now features a connectorized wiring harness, which will ease installation, removal, and maintenance. The Sander switch also now utilizes relay control, which will improve reliability due to the removal of high voltage.

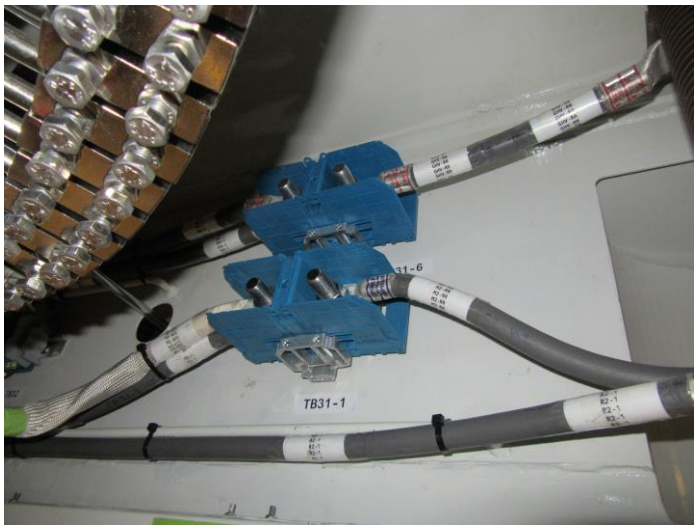
Figure 30 – Connectorized Gang Switch Assembly



3.5 Terminal Blocks

Terminal blocks have been added in multiple locations. This will allow for easier maintenance by removing long wire runs, providing points for diagnostic testing, and making removal and installation of components easier.

Figure 31 – Accelerator Drum Terminal Blocks



3.6 Accelerator Drum Cover

Brookville plans to install a fiberglass Accelerator Drum cover. They spoke of the issue of arcing found on the metal Accelerator Drum pan, and came up with this solution in order to prevent future instances of arching. Bonding straps were not installed at time of visit, but will be installed on the Accelerator Drum Enclosure Cover and all other undercar propulsion enclosure covers. Feedback was given to Brookville to make removal of these pans easier for road calls.

Figure 32 – Accelerator Drum Fiberglass Cover

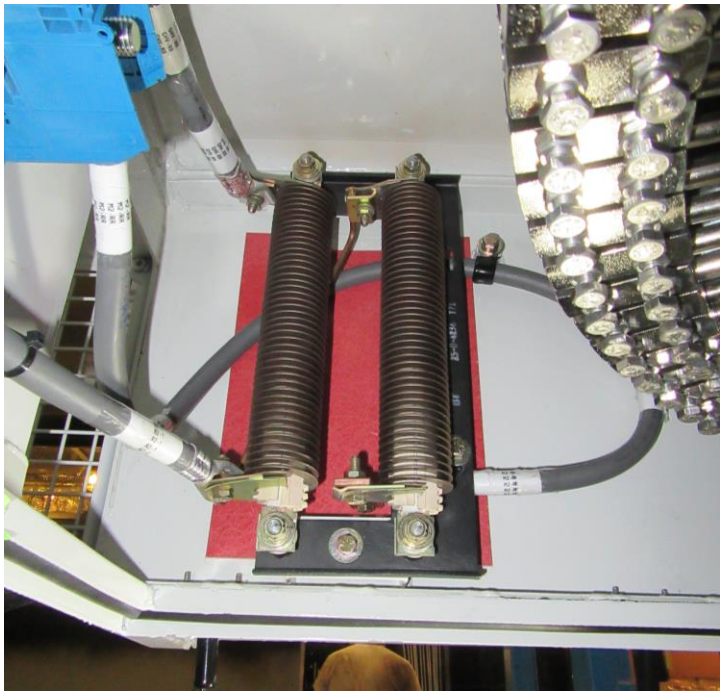
3.7 Relocated Items

Acceleration and braking resistors are now located in a new enclosure next to the #4 door. This new enclosure will ease maintenance activities where these resistors have to be adjusted. Previously these resistors had to be accessed from under the car, which could be especially difficult.

Figure 33 – New Resistor Compartment

R1 and R2 resistors are now located in the Accelerator Drum Enclosure.

Figure 34 – R1 and R2 Resistors



Traction motor fuses are now located in the Hi-Voltage Enclosure.

Figure 35 – Traction Motor Fuses

3.8 Side skirt

A flip-up side skirt is located at the former location of the Master Controller. The flip function of this skirt has been questioned since there doesn't seem to be any equipment that requires access in this area. Brookville stated that this skirt can be used to inspect the truck or remove obstructions.

Figure 36 – Side Skirt

3.9 Undercar Enclosure Lid seals and latches

New lid seals are softer and more pliable, so will improve seal between lid and enclosure. Latches changed from rubber to steel springs to also help improve seal and water tightness.

Figure 37 - Undercar Enclosure Lid Seal and Latch

3.10 Battery compartment drain

The Battery compartment is subject to flushing and washing by the PCC shop, which can allow water to collect in the compartment. This issue was brought up with Brookville, who stated that this feature might be something to add on later builds, subject to internal approval.

Figure 38 – Battery Compartment

3.11 Additional Guidance Needed

Brookville requested additional information and guidance regarding the following topics:

- Truck rebuilds – Fastener type, Nylock vs Norlock
- Harris Radio – Power and space requirements
- Testing and Verification – Internal test procedures which can be conducted at Brookville
- NextBus – Power supply requirements
- Clipper Card – Power supply requirements and dimensions
- Door Sensitive Edge – Go / No-go verification bar dimensions
- Wire Tags – include wire destination on the wire tag?

4. Conclusion and Recommendations

Overhaul repairs and wiring updates appear well thought out and executed. Overhaul is ongoing, with wiring being completed and installation of additional equipment and interior yet to be completed. Potential improvements to serviceability have been offered for discussion. Final direction from SF MUNI should be given to Brookville regarding these items.