FINAL REPORT OF INVESTIGATION A&I E18368

August 25, 2018

Train Pull Apart

Adopted by the Metrorail Safety Commission at its meeting on July 11, 2019.

Washington Metrorail Safety Commission
777 North Capitol Street, NE, Suite 402
Washington, DC 20002

FINAL REPORT OF INVESTIGATION A&I E18368

SMS 20180825#73780MX

Date of Event:	8/25/2018
Type of Event:	Other Actions
Incident Time:	10:55 hrs.
Location:	McClean Station (N01)
Time and How received by SAFE:	10:44 hrs., SAFE On-Call
Safety Officer Response:	Yes
Time of Safety Officer Arrival:	12:15 hrs.
Time of Safety Officer Departure:	17:00 hrs.
Rail Vehicle:	L6141-40-6178-79.**6039-38**.6081-80T
Injuries:	None
Damage:	Semi-Permanent Drawbar of car 6038-39
Emergency Responders:	Emergency Response Team (ERT), Operation Emergency Management (OEM), Department of Safety and Environmental Management (SAFE), Metropolitan Transit Police Department (MTPD) and Office of Car Maintenance (CMNT)

Executive Summary

On Saturday, August 25, 2018 at 10:55 hrs., the Rail Operations Control Center (ROCC) notified SAFE at approximately 10:41 hrs., a Train Operator (T/O) operating an inbound Silver Line Train ID 604 on Track 1 in the direction of East Falls Church Station (K05) reported the train dumped un-commanded, the console train length indication read four cars, and attempts to recharge the Brake Pipe after servicing the N01 was unsuccessful. ROCC instructed Train ID 604 T/O to make announcements, key down, perform a radio check using portable radio, inspect the consist for brake trouble lights, and anything unusual. At approximately 10:50 hrs., Train ID 604 T/O reported car 6038 and 6039 had pulled apart at least 4 feet. Train ID 604 T/O reported damage to the Semi-Permanent Drawbar and exposed “train-line” wiring. ROCC Assistant Superintendent, Rail Operations Information Center (ROIC), Maintenance Operation Center (MOC), Metropolitan Transit Police Department (MTPD), and Department of Safety and Environmental Management (SAFE) were notified of the event.

In response, a CMNT Road Mechanic (R/M) and Rail Transportation (RTRA) Supervisor (RT/S) were dispatched. Based on instruction from ROCC, the RT/S directed the evacuation of eight (8) customers aboard the separated cars to Train ID 705. The 60

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Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

customers aboard the cars on the downtown direction to West Falls Church (K06) were evacuated to Train ID 776 later re-blocked to Train ID 676 and placed in revenue service.

Based on post-incident inspection, event log data, Vehicle Program Services (CENV) bolt analysis, interviews, and procedural review, it revealed the following information related to the pull-a-part event:

- CMNT did not have an approved Semi-Permanent Drawbar overhaul procedure for rebuild processes
- CMNT used the incorrect bolt for Semi-Permanent rebuild process
- The buffer tube lock screw installed of the affected component was identified as cross-threaded during inspection
- Cross-threads on the bolt provided a false torque reading resulting in reduced clamping force on the buffer tube, which in-turn allowed the spanner nut to slowly back out over time; leading to the draft arm and spring pack pulling out of the buffer tube causing married pair Car 6038 and Car 6039 to pull apart at the Semi-Permanent Drawbar
- Extensive heat generated by the use of power tools resulted in the stripping of the threads.
- CMNT personnel did not audit the Semi-Permanent overhaul process in accordance to Maintenance Service Instructions (MSI) 150088.

Considering all the salient facts, SAFE concludes, CMNT personnel failed to follow written approved procedure to ensure the correct bolt was used during the rebuild process, failed to audit the affected Drawbar to ensure compliance, and failed to follow Standard Operating Procedure (SOP) 3.08 restricting use of power tools on bolts.

There were no reported injuries or damage to the track as a result of this incident.

The supervisor determined that Post-Incident Testing would not be conducted due to incident not meeting the authorities' criteria.

Notification

Title	Time	Comment:
FTA	11:25 hrs.	
WMSC	11:25 hrs.	

Incident Site

The incident area was located outside N01 station. The area is described as a:

- Restricted View: Curve/Aerial
- 1100 feet inbound of N01 platform area
- Direct fixation Track
- Chain Marker (CM) N1-633+00, Track 1

Field Sketch/Schematics

Investigation

On Saturday, August 25, 2018 at 10:55 hrs., Train ID 604 T/O reported the train dumped, console train length indication was reading four (4) cars and was unable to recharge the Brake Pipe. ROCC instructed Train ID 604 T/O to make announcements, key down, perform a radio check on the portable radio, inspect the consist for brake trouble lights, and anything unusual. After walking the consist, Train ID 604 T/O reported car 6038 and 6039 had pulled apart at least 4 feet. ROCC Assistant Superintendent, ROIC, MOC, MTPD, and SAFE were notified accordingly. Train ID 604 T/O reported eight (8) customers aboard cars on the Wiehle-Reston (N06) end and Sixty (60) customers aboard the cars on the downtown direction to K06. ROCC instructed T/O Train ID 604 to place a Handbrake on both sets of the affected trains and advise ROCC of car numbers. ROCC appointed T/O of Train ID 604 On Scene Commander (OSC). T/O of Train ID 604 informed ROCC Handbrakes were applied on car 6141 and 6080. Automatic Train Control (ATC) Technician and CMNT R/M arrived at the scene for single tracking and mechanical support. ROCC instructed ATC 2 to clamp N92-1A and N92-1B to allow for a rescue train to enter the area. Rail Transportation Supervisor (RT/S) arrived at N01 and boarded Train ID 705 to assist with rescue efforts. ROCC then gave Train ID 705 a permissive block within two (2) feet of the down train using close in procedures to rescue the customers from the affect consist. ROCC gave Train ID 776 an absolute block from N92 to cross the interlocking verifying N92-1A and N92-1B switches were clamped in reversed with switch points tucked. RT/S arrived with Train ID 705, ROCC designated the RT/S as the RTRA forward liaison at 11:21 hrs. The RT/S later verified there were 8-customers aboard the separated cars as previously reported. Thereafter, the RT/S reported all customers were

clear of the trailing set of separated cars. ERT arrived at N01 to perform a walking track inspection from N01's platform to the down trains location to check for track damage. ROCC gave T/O of Train ID 705 an absolute block from the down train to the platform at N01 to offload the customers from the trailing separated cars. ROCC instructed ATC 2 to unclamp switches N92-1A and N92-1B. ATC 2 notified ROCC; switches N92-1A and N92-1B were verified unclamped and all personnel were standing in a place of safety for train movement. ROCC gave Train ID 705 an absolute block from N01 to N02 by way of track one to cross over at Tysons Corner (N02) interlocking and non-revenue back to N06. RTRA forward liaison reported all customers were clear of the separated cars on the downtown end of the incident train. ROCC then gave Train ID 776 a permissive block to N92-02 after verifying that all personnel and equipment were clear. All customers were reported safely on-board and the train was secured for service. ROCC instructed Train ID 776 to re-block the ID to 676 and continue service from K05 to Foggy Bottom (C04). At this time, Train service continued to single-track from N01 to N92 by way of Track 2. ERT entered the roadway by way of a train drop off to perform a walking track inspection from the down trains location to the platform at N01 on Track 1. ERT reported a clear track inspection from the down trains location to the platform at N01 on Track 1. SAFE arrived at N01 to walk to the down train. SAFE entered the roadway to perform a walking track inspection from the platform at N01 to the incident train. CMNT R/M arrived at N01 to assist in removing the disable train from mainline. At 13:59 hrs., SAFE requested Foul Time (F/T) on Track 1 and Track 2 to perform a ground walk around on a curve (Hot Spot) to inspect the train pull apart and roadway equipment for damage. ROCC granted F/T at 14:07 hrs., after SAFE confirmed repeat back of Red Signal at N92-08 and Prohibit Exit at N92-06. SAFE relinquished F/T to ROCC at 14:14 hrs. Thereafter, SAFE and CMNT personnel deemed the affected train and area safe for CMNT R/M to commence recovery efforts. RT/S notified ROCC that Car 6179 was uncoupled from Car 6039. CMNT R/M boarded the trailing car to perform Brake person duties for the 5-cars ready to move non-revenue in the direction of K06. ROCC instructed RTRA forward liaison, to verify all personnel and equipment were clear, and perform a rolling test and rolling brake test. RTRA forward liaison, now operating Train ID 704; verified all personnel and equipment were clear, and verified train was Rolling Free and a good Rolling Brake test were performed satisfactorily. ROCC granted Train ID 704 a permissive block to K99-100 signal with speeds not to exceed 10 mph. Recovery Train ID 850 arrived at N01, Track 1 to assist with removal of the last 3-cars. ROCC granted Train ID 850 a permissive block no closer than 10 feet of the disable train while utilizing safety stops, and close-in procedures. Train ID 850 T/O requested permission from ROCC to enter the roadway to cut out rate lines on both consist. ROCC granted Train ID 850 T/O permission to enter the roadway. Train ID 850 T/O informed ROCC that train rate lines were cut out of both consist and was back aboard Train ID 850. ROCC granted T/O of Train ID 850 permission to make an add to the disabled train. T/O of Train ID 850 notified ROCC the add was

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made to the disable train; cars 3144 and 6038 were now coupled. T/O of Train 850 notified ROCC, the recovery Train ID 850, had good brakes off and was able to move free. ROCC granted Train ID 850 T/O a permissive block to K99-100 signal. The down train successfully reached K99 yard without further incident.

Resourced Evidence / Actual Event Account:

Office of Car Maintenance (CMNT)

During inspection, CMNT personnel determined the Semi-Permanent Drawbar between married pair 6038 and 6039 separated after the Spanner nut located on Car 6038 side of the Semi-Permanent Drawbar had dislodged from the Buffer Tube. All identified discrepancies were repaired to the affected consist. (Refer to Attachments 4-5).

Employee Re-training

The employee involved in the re-build process of the affected Drawbar was not re-trained as a result of this event due to change of job and work location. The employee no longer re-builds front and or Semi-Permanent drawbars.

Overhaul Procedures

CMNT personnel were using approved MSI 150088 (February 28, 2017) prior to the event, which is an approved front coupler procedure. However, at the time of this event, there was no approved overhaul procedure for the Semi-Permanent Drawbar. CENV personnel are in the process of developing an MSI 150091 for 6K Semi-Permanent Drawbar overhaul as a corrective action.

Semi-Permanent Drawbar Audit Process

CMNT personnel reported, the Semi-Permanent Drawbar assembly is audited during overhaul to ensure the correct bolts are used and torqued to specification outlined in MSI 150088. However, there is no supporting documentation from CMNT substantiating this occurred.

Temporary suspension of overhaul

CMNT temporarily suspended overhaul processes on August 26, 2018, verbal instructions were given to management personnel to cease operations to rebuild Semi-Permanent drawbars and front couplers until the correct bolts were in-stock. The correct bolts arrived in stock on January 25, 2019, at that time, rebuild processes resumed.

Vehicle Program Services

After investigation, CENV concluded the pull apart of Train ID 604 (Cars 6038-39), culminated with the finding of stripped threads on the Buffer Tube Locking screw. The

stripped threads provided a false torque reading. The false torque reading led to a reduced clamping force of the buffer tube, which is designed to lock the spanner nut in position. Insufficient clamping force allowed the spanner nut to slowly back out over time, leading to the draft arm (and spring pack) being pulled out of the buffer tube, consequently causing the incident where the cars separated. The stripping of the threads was caused by extensive heat generated due to the use of power tools. Refer to attachments 6

Leigh Testing Laboratories Report

Please refer to attachment 9 for bolt analysis failure report.

Communications Section (COMM)

Upon further inspection, COMM did not report any anomalies with the radio system in the affected area.

Closed Circuit Television

There is no CCTV footage in proximity of the incident area.

Office of Procurement and Materials (PRMT)

There was no supportive documentation available for SAFE's review.

Human Factors

Post-Incident Testing

Due to WMATA's Post-Incident Testing criteria, the T/O was not subjected to testing as a result of this event.

Fatigue

Based on SAFE's review of the T/O's 30-day work history, it was determined that the T/O hours of service was in accordance with WMATA's *Fatigue Risk Management Policy 10.6* and *Hours of Service Limitations for Prevention of Fatigue Policy 10.7*.

Weather

At the time of the incident, the temperature was 77°F, Mostly Cloudy and SAFE has concluded that weather was not a contributing factor in this incident (Weather source: National Oceanic Atmospheric Administration (NOAA) – Location: Washington, DC.)

Findings

- Train ID 604 final point of rest at CM N1-633+00
- Semi-Permanent Drawbar between married pairs 6038 and 6039 separated
- The Spanner nut located on the Car 6038 side of the Semi-Permanent Drawbar had dislodge from the Buffer Tube (see attachment 1 and 2).
- The incorrect Zinc plated 10.9 bolt(s) were in stock under the OEM part number instead of OEM A4-80 (Stainless steel bolt).
- Cross-threads on the bolt provided a false torque reading resulting in reduced clamping force on the buffer tube, which in-turn allowed the spanner nut to slowly back out over time; leading to the draft arm and spring pack pulling out of the buffer tube causing married pair Car 6038 and Car 6039 to pull apart at the Semi-Permanent Drawbar.
- Extensive heat generated by the use of power tools resulted in the stripping of the threads.

Conclusion

Based on salient facts as part of this investigation, SAFE is in concurrence with CENV findings and has concluded several factors:

1. The buffer tube lock screw installed of the affected component was identified as cross-threaded during inspection.
2. Cross-threads on the incorrect bolt provided a false torque reading resulting in reduced clamping force on the buffer tube, which in-turn allowed the spanner nut to slowly back out over time; leading to the draft arm and spring pack pulling out of the buffer tube causing married pair Car 6038 and Car 6039 to pull apart at the Semi-Permanent Drawbar.
3. Extensive heat generated by the use of power tools resulted in the stripping of the threads.

As a result of this investigation, the combination of the above stated facts consequently contributed to the pull apart event.

Immediate Mitigation to Prevent Recurrence

- Train ID 604 removed from service for Post-Incident Inspection
- CMNT 5K and 6K Series railcar fleet inspection performed on Semi-Permanent drawbars
- CMNT suspended overhaul processes on August 8, 2018
- The incorrect zinc plated 10.9 bolts were removed from stock and the part description corrected within Windchill.
- CMNT repairs commenced on 08/25/2018 and were completed on 01/07/2019. Refer to attachments 4 and 5

- CMNT revisited written instructions to CMNT personnel prohibiting the use of power tools when installing bolts. Refer to attachment 8
- CENV developed a Service Bulletin SBE-120 authorizing inspection of 5K/6K Drawbar/Draft Gear assembly on 09/04/2018. Refer to attachment 7

Corrective Action Plan

1. CENV shall take the appropriate action to include but not limited to the development of MSI 150091 outlining rebuild procedures for 6K Semi-Permanent Drawbars and any other action deemed necessary to support prevention of repeated pull apart event:

    a. CENV developed MSI 150091 and currently undergoing review for approval.

Photos

Drafted By: SAFE 704 – 04/19/2019
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Photo 1 – Train ID 604 final rest point, CM N1-633+00

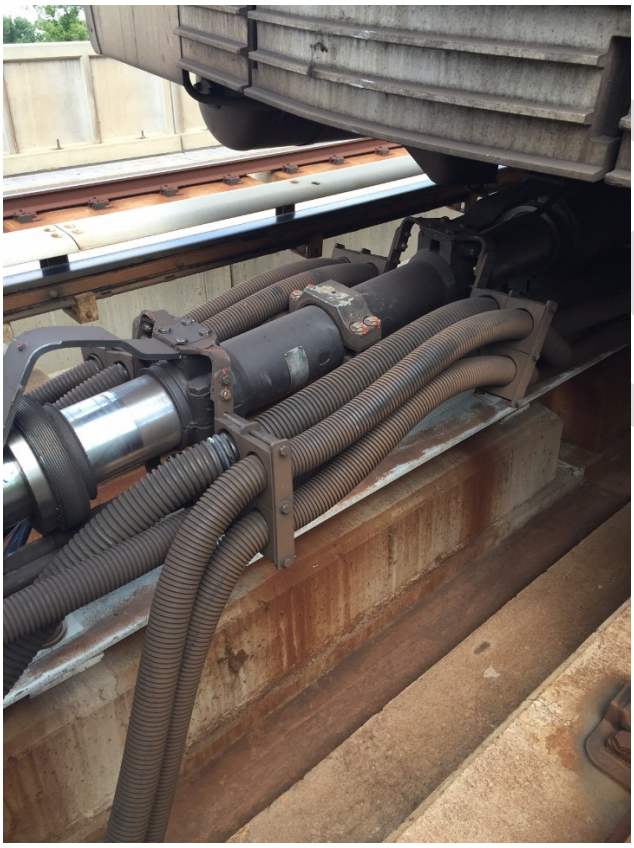

Photo 2 – Car 6039 Semi-Permanent Drawbar

Drafted By: SAFE 704 – 04/19/2019
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Photo 3 – Car 6039 Friction Spring

Photo 4 – Car 6038 Trainline Wiring Damage

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Photo 5 – Car 6038 Buffer Tube Screw torque strip moved

Attachments

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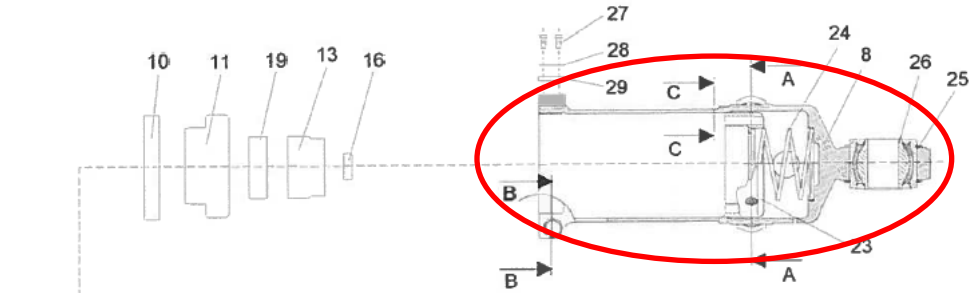
Disassemble Buffer (Figure 8-5-13)



Legend

1 Bolt	11 Guide Ring	21 Capscrew
2 Washer	12 Friction Spring	22 Shear Pin
3 Locknut	13 Nut	23 Shear Ring
4 Nut	14 Screw	24 Spring
5 Draft Bar	15 Securing Plate	25 Retaining Ring
6 Stripper	16 Key	26 Spherical Rubber Bearing
7 Bearing	17 Guide Ring	27 Screw
8 Buffer Tube	18 Bearing	28 Securing Plate
9 Screw	19 Bearing	29 Plate
10 Bearing	20 Lock Wire	

6k-08-0076

Figure 8-5-13. Buffer Overhaul (1 of 2)

Attachment 1 – Semi-Permanent Drawbar illustrated parts breakdown fig. 1

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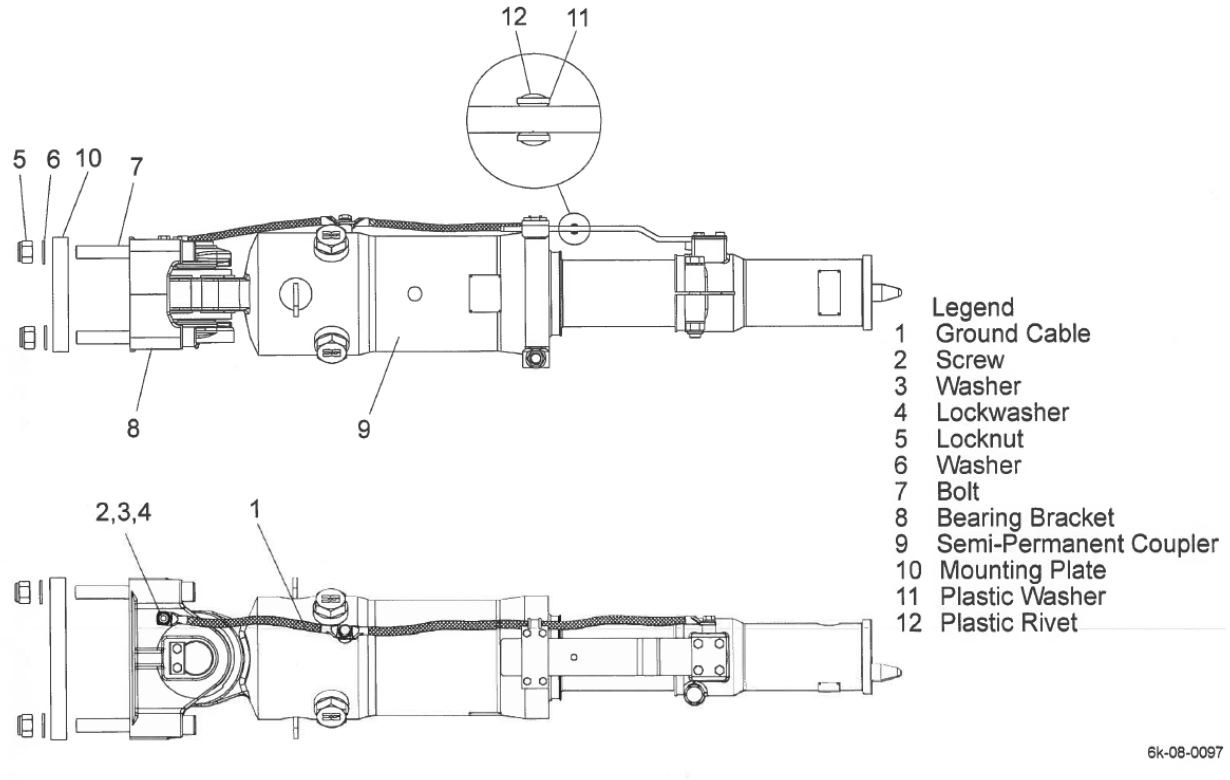

Attachment 2 – Semi-Permanent Drawbar illustrated parts breakdown fig. 2

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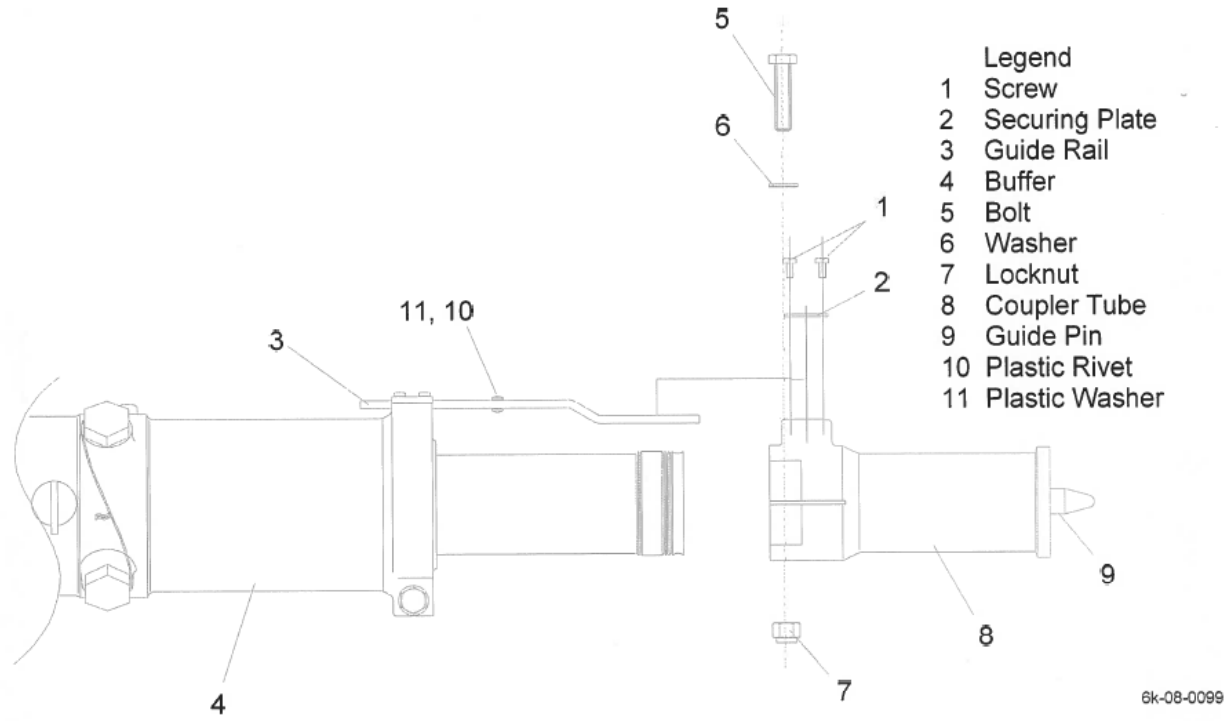

Attachment 3 – Semi-Permanent Drawbar illustrated parts breakdown fig. 3

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Washington Metropolitan Area Transit Authority
Maintenance and Material Management System
Work Order Details

Work Order #: 14484975
Type: CM

Status: COMP
01/07/2019 05:45

Work Description: TRAIN PULL APART, 61/0, N01, CMD, CUPL, 604
Job Plan Description:

INCIDENT OCCURED BETWEEN THE MARRIED PAIR 6038-6039

Work Information

Asset: R6038	6038, RAIL CAR, ALSTOM, 6000 AC, A CAR	**Owning Office:** CMNT-CMNT-CMNT		**Parent:**	
Asset Tag: R6038		**Maintenance Office:** CMNT-NEWC-INSP		**Create Date:** 08/25/2018 18:31	
Asset S/N: 6038		**Labor Group:**		**Actual Start:** 08/25/2018 18:34	
Location: 1230	D99, NEW CARROLLTON YARD	**Crew:**		**Actual Comp:** 01/07/2019 05:45	
Work Location: SHOP561	BRENTWOOD TRUCK SHOP	**Lead:**		**Item:** A18050001	
Failure Class: CMNT012	COUPLER	**GL Account:** WMATA-02-33393-50499160-041-**********-*****-OPR**			
Problem Code: 3303	UNDESIRED UNCOUPLING	**Supervisor:** [redacted]		**Target Start:**	
Requested By:		**Requestor Phone:**		**Target Comp:**	
Chain Mark Start:		**Chain Mark End:**		**Scheduled Start:**	
Create-Mileage: 854522.0		**Complete-Mileage:** 854858.0			

Task IDs

Task ID						
10	Removed drawbar and electrical connections. Prepared for transport to Greenbelt.					
Component:	000-300-L05 SEMI PERMANENT COUPLING GROUP (REAR/DRAWBAR/DRAFT END) 2K/3K/5K/6K	**Work Accomp:** REMOVED	**Reason:** DAMAGED	**Status:** COMP	**Position:**	**Warranty?:** N
20	R AND R DRAWBAR TORQUED AND TORQUE STRIP ALL HARDWARE NEW A CAR ASS#419586(SN:179) NEW B CAR ASS#406479(SN:086)					
Component:	000-300-L11-002 DRAWBAR, SEMIPERMANENT, REAR, A-CAR; DRAWBAR; 7K	**Work Accomp:** REPLACED REBUILT	**Reason:** INCIDENT//ACCIDENT	**Status:** COMP	**Position:**	**Warranty?:** N
30	STRIPED HARDWARE FROM DAMAGED CABLES AND WIRING / PALETED, BANDED AND STORED DAMAGED CABLES AND WIRING FOR PICK UP TO GREEN BELT / STRIPED HARDWARE FROM DAMAGED CABLES AND WIRING / PALETED, BANDED AND STORED DAMAGED CABLES AND WIRING FOR PICK UP TO GREEN BELT / ALSO PUT STRIPED HARDWARE (BRACKETS, ANTENNA, ETC...) INSIDE CAR #6039 FOR SHIPMENT TO BRENTWOOD.					
Component:	000-300-L05 SEMI PERMANENT COUPLING GROUP (REAR/DRAWBAR/DRAFT END) 2K/3K/5K/6K	**Work Accomp:** SECURED	**Reason:** CHANGE OFF	**Status:** COMP	**Position:** 825	**Warranty?:** N
40	repair damaged jumper cables TL1,3,4,5,6,7,8,9 replace all damaged wires and connectors as needed					
Component:	000-300-A05 CAR LOGIC: TRAINLINE CAR TO CAR JUMPERS/CABLES	**Work Accomp:** NOT COMPLETED - WORK OR TASK	**Reason:** DAMAGED	**Status:** COMP	**Position:** 232	**Warranty?:** N
50	repair of damage brackets remove and repair of car to car jumper brackets					
Component:	000-300-L00 SUBSYSTEM; COUPLER & DRAWBAR/ DRAFT GEAR	**Work Accomp:** REPAIRED	**Reason:** DAMAGED	**Status:** COMP	**Position:** 232	**Warranty?:** N
60	repair and replace of air line and car to car jumpers removed air line from 6094 and put on 6038 for test removed broken bracket for repair - adjusting car to car jumpers for better fit *WIP					

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Attachment 4 – Repair Work-order 14484975 for Car 6038 page 1 of 6

Drafted By: SAFE 704 – 04/19/2019
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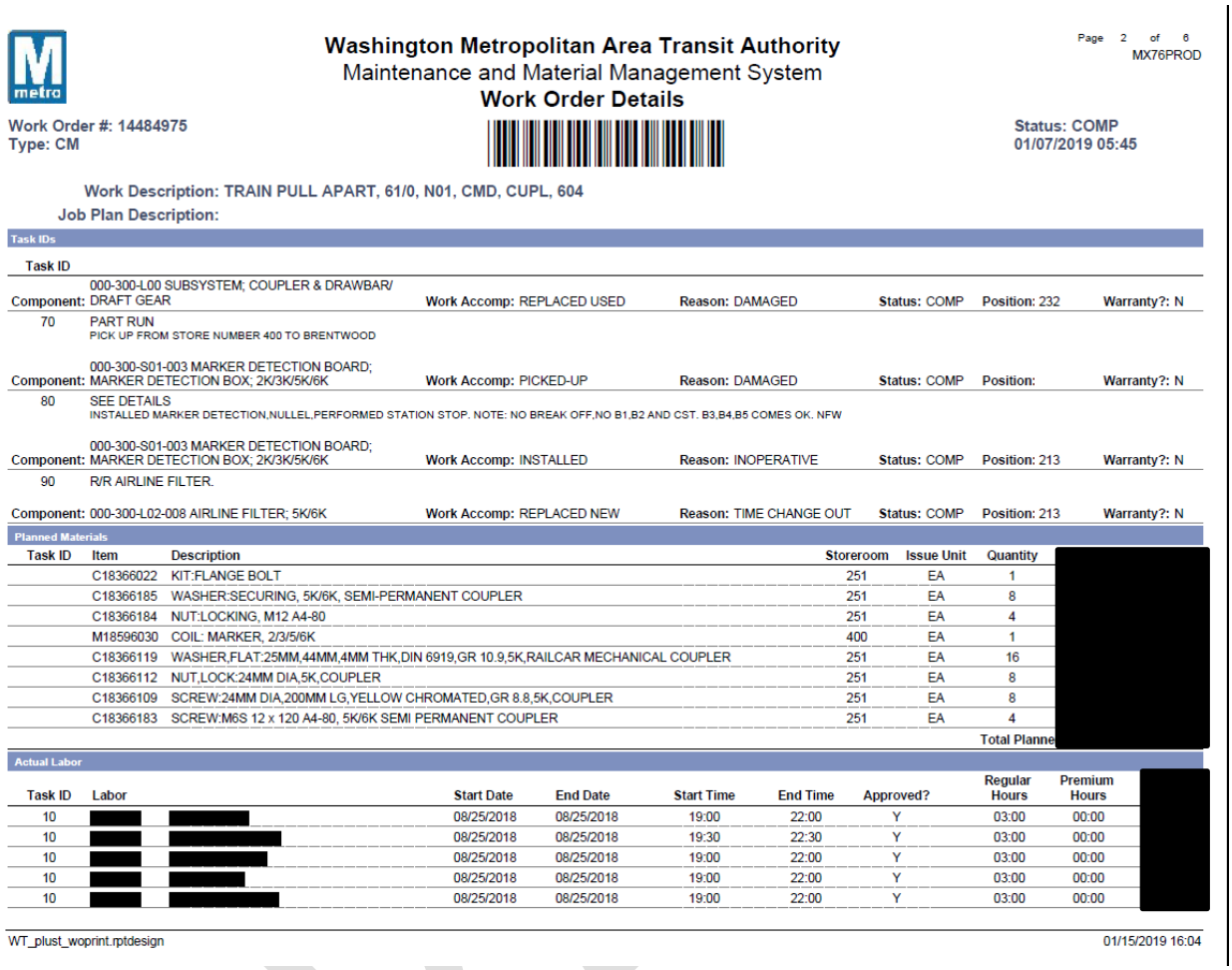
Approved By: SAFE 70 – 05/24/2019



Washington Metropolitan Area Transit Authority
Maintenance and Material Management System
Work Order Details

Page 2 of 6
MX76PROD

Work Order #: 14484975
Type: CM

Status: COMP
01/07/2019 05:45

Work Description: TRAIN PULL APART, 61/0, N01, CMD, CUPL, 604
Job Plan Description:

Task IDs

Task ID						
Component: 000-300-L00 SUBSYSTEM; COUPLER & DRAWBAR/ DRAFT GEAR	Work Accomp: REPLACED USED	Reason: DAMAGED	Status: COMP	Position: 232	Warranty?: N	
70	PART RUN PICK UP FROM STORE NUMBER 400 TO BRENTWOOD					
Component: 000-300-S01-003 MARKER DETECTION BOARD; MARKER DETECTION BOX; 2K/3K/5K/6K	Work Accomp: PICKED-UP	Reason: DAMAGED	Status: COMP	Position:	Warranty?: N	
80	SEE DETAILS INSTALLED MARKER DETECTION,NULLEL,PERFORMED STATION STOP. NOTE: NO BREAK OFF,NO B1,B2 AND CST. B3,B4,B5 COMES OK. NFW					
Component: 000-300-S01-003 MARKER DETECTION BOARD; MARKER DETECTION BOX; 2K/3K/5K/6K	Work Accomp: INSTALLED	Reason: INOPERATIVE	Status: COMP	Position: 213	Warranty?: N	
90	R/R AIRLINE FILTER.					
Component: 000-300-L02-008 AIRLINE FILTER; 5K/6K	Work Accomp: REPLACED NEW	Reason: TIME CHANGE OUT	Status: COMP	Position: 213	Warranty?: N	

Planned Materials

Task ID	Item	Description	Storeroom	Issue Unit	Quantity
	C18366022	KIT:FLANGE BOLT	251	EA	1
	C18366185	WASHER:SECURING, 5K/6K, SEMI-PERMANENT COUPLER	251	EA	8
	C18366184	NUT:LOCKING, M12 A4-80	251	EA	4
	M18596030	COIL: MARKER, 2/3/5/6K	400	EA	1
	C18366119	WASHER,FLAT:25MM,44MM,4MM THK,DIN 6919,GR 10.9,5K,RAILCAR MECHANICAL COUPLER	251	EA	16
	C18366112	NUT,LOCK:24MM DIA,5K,COUPLER	251	EA	8
	C18366109	SCREW:24MM DIA,200MM LG,YELLOW CHROMATED,GR 8.8,5K,COUPLER	251	EA	8
	C18366183	SCREW:M6S 12 x 120 A4-80, 5K/6K SEMI PERMANENT COUPLER	251	EA	4
					Total Planne

Actual Labor

Task ID	Labor	Start Date	End Date	Start Time	End Time	Approved?	Regular Hours	Premium Hours
10		08/25/2018	08/25/2018	19:00	22:00	Y	03:00	00:00
10		08/25/2018	08/25/2018	19:30	22:30	Y	03:00	00:00
10		08/25/2018	08/25/2018	19:00	22:00	Y	03:00	00:00
10		08/25/2018	08/25/2018	19:00	22:00	Y	03:00	00:00
10		08/25/2018	08/25/2018	19:00	22:00	Y	03:00	00:00

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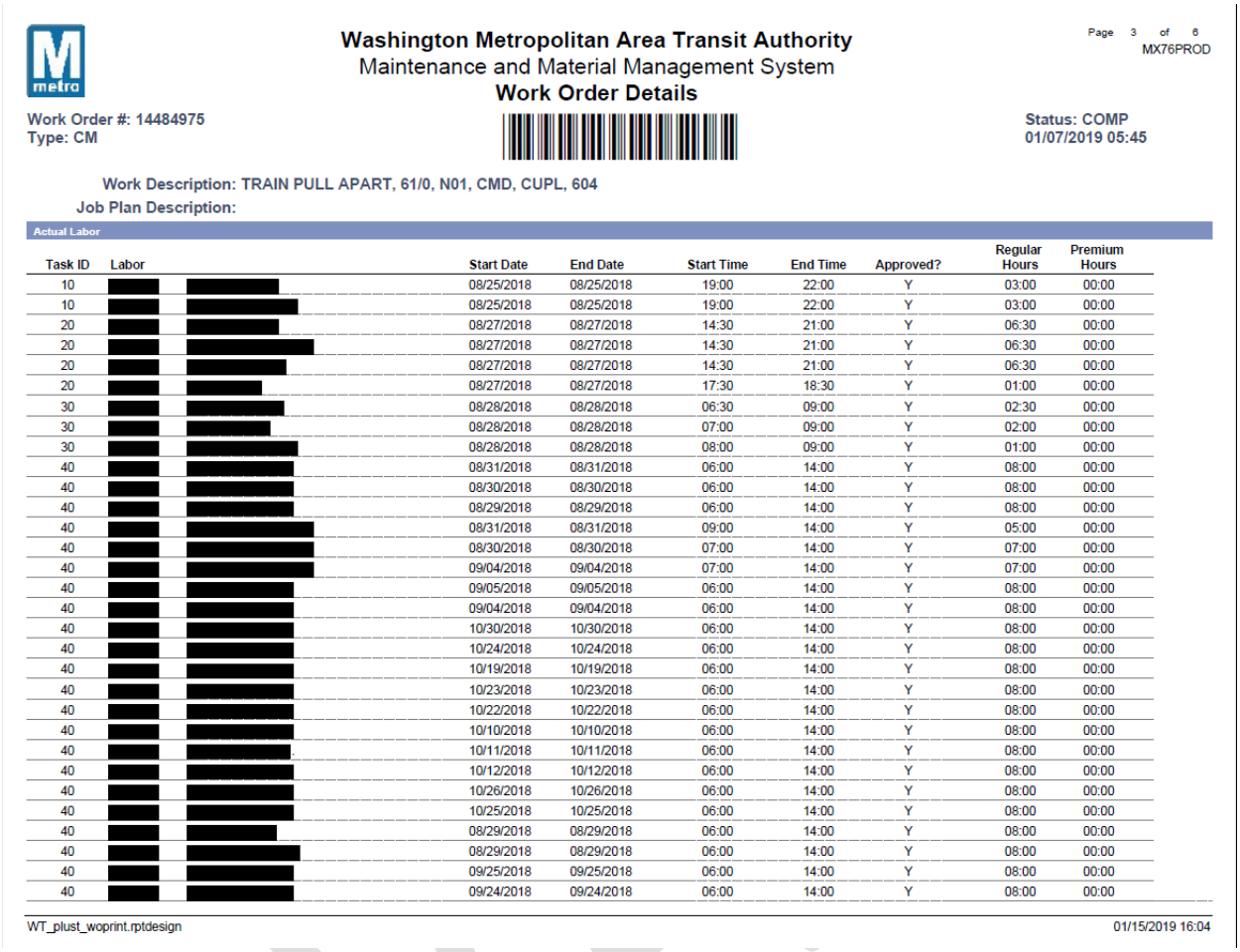
Attachment 4– Repair Work-order 14484975 for Car 6038 page 2 of 6

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019



Washington Metropolitan Area Transit Authority
Maintenance and Material Management System
Work Order Details

Work Order #: 14484975
Type: CM

Status: COMP
01/07/2019 05:45

Work Description: TRAIN PULL APART, 61/0, N01, CMD, CUPL, 604
Job Plan Description:

Actual Labor

Task ID	Labor	Start Date	End Date	Start Time	End Time	Approved?	Regular Hours	Premium Hours
10	[redacted]	08/25/2018	08/25/2018	19:00	22:00	Y	03:00	00:00
10	[redacted]	08/25/2018	08/25/2018	19:00	22:00	Y	03:00	00:00
20	[redacted]	08/27/2018	08/27/2018	14:30	21:00	Y	06:30	00:00
20	[redacted]	08/27/2018	08/27/2018	14:30	21:00	Y	06:30	00:00
20	[redacted]	08/27/2018	08/27/2018	14:30	21:00	Y	06:30	00:00
20	[redacted]	08/27/2018	08/27/2018	17:30	18:30	Y	01:00	00:00
30	[redacted]	08/28/2018	08/28/2018	06:30	09:00	Y	02:30	00:00
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40	[redacted]	08/30/2018	08/30/2018	07:00	14:00	Y	07:00	00:00
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Attachment 4 – Repair Work-order 14484975 for Car 6038 page 3 of 6

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

Washington Metropolitan Area Transit Authority
Maintenance and Material Management System
Work Order Details

Work Order #: 14484975
Type: CM

Status: COMP
01/07/2019 05:45

Work Description: TRAIN PULL APART, 61/0, N01, CMD, CUPL, 604
Job Plan Description:

Actual Labor

Task ID	Labor	Start Date	End Date	Start Time	End Time	Approved?	Regular Hours	Premium Hours
40	[redacted]	09/13/2018	09/13/2018	06:00	14:00	Y	08:00	00:00
40	[redacted]	09/17/2018	09/17/2018	06:00	14:00	Y	08:00	00:00
40	[redacted]	09/14/2018	09/14/2018	06:00	14:00	Y	08:00	00:00
40	[redacted]	09/19/2018	09/19/2018	06:00	14:00	Y	08:00	00:00
40	[redacted]	09/18/2018	09/18/2018	06:00	14:00	Y	08:00	00:00
40	[redacted]	09/21/2018	09/21/2018	06:00	14:00	Y	08:00	00:00
40	[redacted]	09/20/2018	09/20/2018	06:00	14:00	Y	08:00	00:00
40	[redacted]	09/12/2018	09/12/2018	06:00	14:00	Y	08:00	00:00
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40	[redacted]	12/20/2018	12/20/2018	02:00	14:00	Y	12:00	00:00
40	[redacted]	12/20/2018	12/20/2018	02:00	14:00	Y	12:00	00:00
40	[redacted]	12/19/2018	12/19/2018	08:00	14:00	Y	06:00	00:00
40	[redacted]	12/19/2018	12/19/2018	02:00	14:00	Y	12:00	00:00
40	[redacted]	12/15/2018	12/15/2018	06:00	10:00	Y	04:00	00:00

Attachment 4 – Repair Work-order 14484975 for Car 6038 page 4 of 6

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

Washington Metropolitan Area Transit Authority
Maintenance and Material Management System
Work Order Details

Work Order #: 14484975
Type: CM

Status: COMP
01/07/2019 05:45

Work Description: TRAIN PULL APART, 61/0, N01, CMD, CUPL, 604
Job Plan Description:

Actual Labor

Task ID	Labor		Start Date	End Date	Start Time	End Time	Approved?	Regular Hours	Premium Hours
40	[redacted]	[redacted]	12/15/2018	12/15/2018	06:00	10:00	Y	04:00	00:00
50	[redacted]	[redacted]	12/18/2018	12/18/2018	06:00	10:00	Y	04:00	00:00
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90	[redacted]	[redacted]	01/02/2019	01/02/2019	15:00	16:00	Y	01:00	00:00
							Total Actual Hour/Labor:	381:00	00:00

Actual Materials

Task ID	Item	Assetnum	Description	Storeroom	Trans Date	Issue Unit	Quantity
	M18596030		COIL: MARKER, 2/3/5/6K	400	12/31/2018	EA	1
	C18366185		WASHER:SECURING, 5K/6K, SEMI-PERMANENT COUPLER	251	08/27/2018	EA	8
	C18366184		NUT:LOCKING, M12 A4-80	251	08/27/2018	EA	4
	C18366119		WASHER,FLAT:25MM,44MM,4MM THK,DIN 6919,GR 10.9,5K,RAILCAR MECHANICAL COUPLER	251	08/27/2018	EA	16
	M18367001	419566	BAR:DRAW,6K,REAR END COUPLER	559	10/25/2018	EA	1
	C18366109		SCREW:24MM DIA,200MM LG,YELLOW CHROMATED,GR 8.8,5K,COUPLER	251	08/27/2018	EA	8
	C18366183		SCREW:M6S 12 x 120 A4-80, 5K/6K SEMI PERMANENT COUPLER	251	08/27/2018	EA	4
	C18366022		KIT:FLANGE BOLT	251	08/27/2018	EA	1
	C18366112		NUT,LOCK:24MM DIA,5K,COUPLER	251	08/27/2018	EA	8

Related Incidents

Ticket	Description	Class	Status	Relationship
8351132	TRAIN PULL APART, 61/307, N01, CMD, CUPL, 604	SR	PENDING	ORIGINATOR

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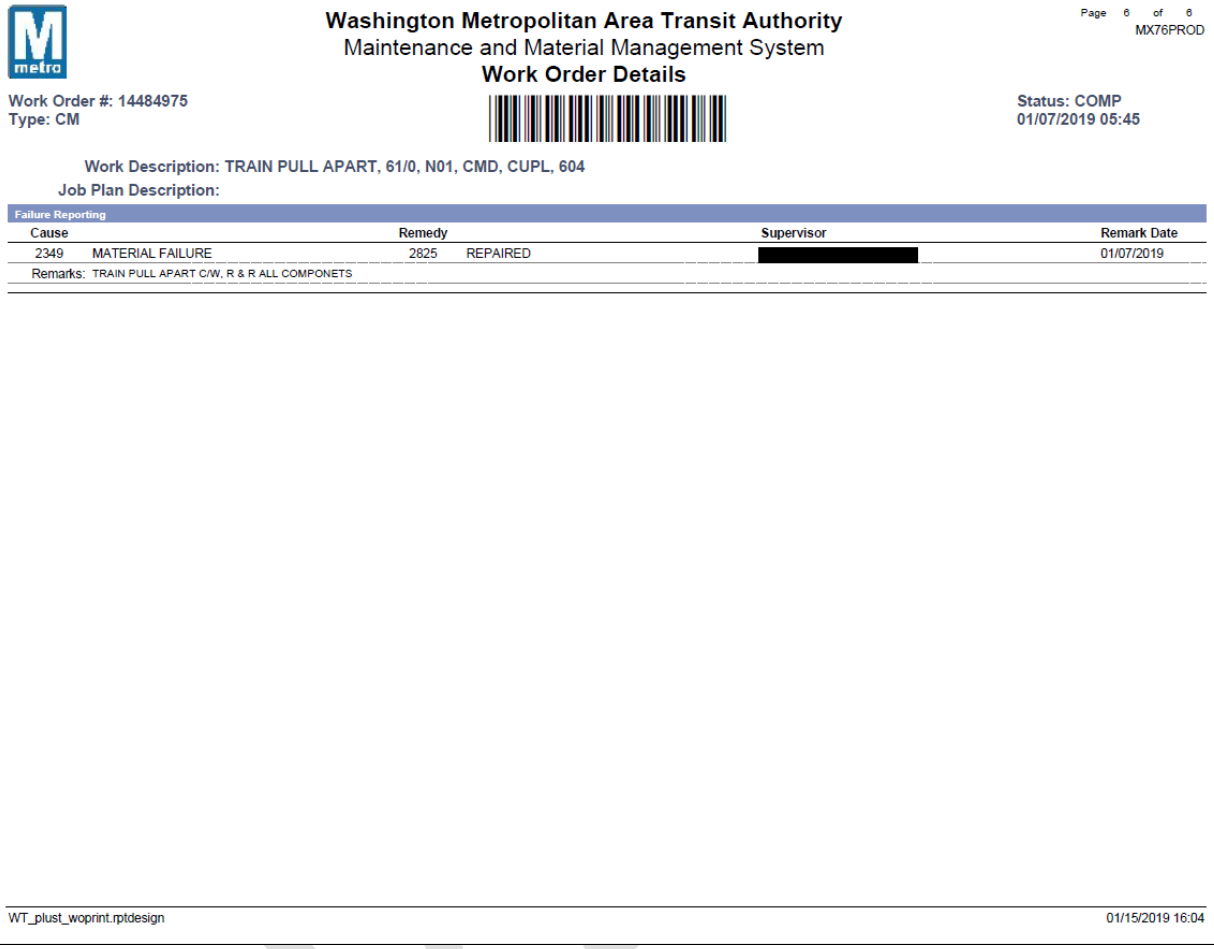
Attachment 4 – Repair Work-order 14484975 for Car 6038 page 5 of 6

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019



Washington Metropolitan Area Transit Authority
Maintenance and Material Management System
Work Order Details

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MX76PROD

Work Order #: 14484975
Type: CM

Status: COMP
01/07/2019 05:45

Work Description: TRAIN PULL APART, 61/0, N01, CMD, CUPL, 604
Job Plan Description:

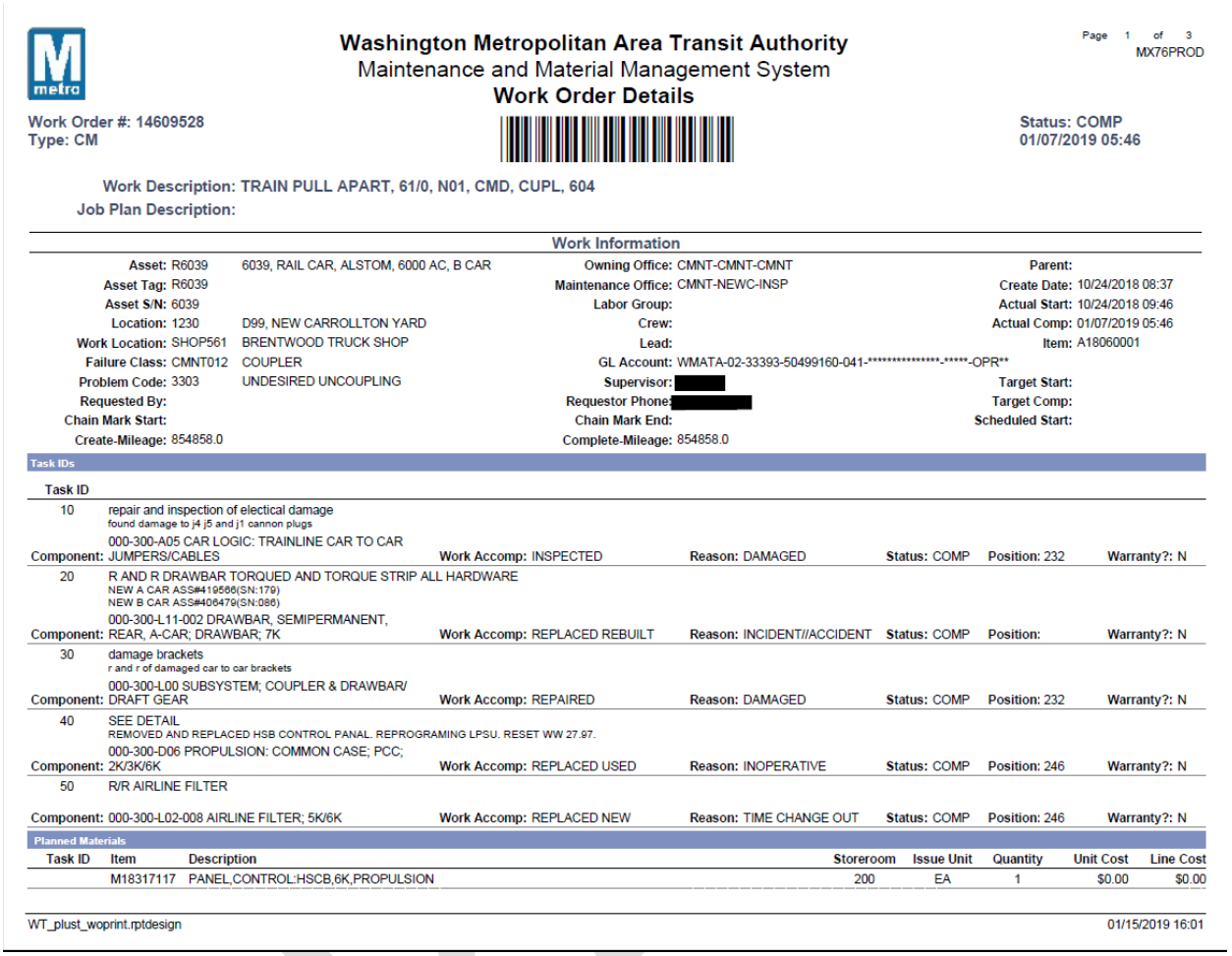
Failure Reporting

Cause		Remedy		Supervisor	Remark Date
2349	MATERIAL FAILURE	2825	REPAIRED	[redacted]	01/07/2019
Remarks:	TRAIN PULL APART C/W, R & R ALL COMPONETS				

WT_plust_woprint.rptdesign 01/15/2019 16:04

Attachment 4 – Repair Work-order 14484975 for Car 6038 page 6 of 6

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019



Washington Metropolitan Area Transit Authority
Maintenance and Material Management System
Work Order Details

Page 1 of 3
MX76PROD

Work Order #: 14609528
Type: CM

Status: COMP
01/07/2019 05:46

Work Description: TRAIN PULL APART, 61/0, N01, CMD, CUPL, 604
Job Plan Description:

Work Information

Asset:	R6039 6039, RAIL CAR, ALSTOM, 6000 AC, B CAR	**Owning Office:**	CMNT-CMNT-CMNT	**Parent:**	
Asset Tag:	R6039	**Maintenance Office:**	CMNT-NEWC-INSP	**Create Date:**	10/24/2018 08:37
Asset S/N:	6039	**Labor Group:**		**Actual Start:**	10/24/2018 09:46
Location:	1230 D99, NEW CARROLLTON YARD	**Crew:**		**Actual Comp:**	01/07/2019 05:46
Work Location:	SHOP561 BRENTWOOD TRUCK SHOP	**Lead:**		**Item:**	A18060001
Failure Class:	CMNT012 COUPLER	**GL Account:**	WMATA-02-33393-50499160-041-**********-*****-OPR**		
Problem Code:	3303 UNDESIRED UNCOUPLING	**Supervisor:**	[redacted]	**Target Start:**	
Requested By:		**Requestor Phone:**	[redacted]	**Target Comp:**	
Chain Mark Start:		**Chain Mark End:**		**Scheduled Start:**	
Create-Mileage:	854858.0	**Complete-Mileage:**	854858.0		

Task IDs

Task ID							
10	repair and inspection of electical damage found damage to j4 j5 and j1 cannon plugs						
Component:	000-300-A05 CAR LOGIC: TRAINLINE CAR TO CAR JUMPERS/CABLES	**Work Accomp:**	INSPECTED	**Reason:** DAMAGED	**Status:** COMP	**Position:** 232	**Warranty?:** N
20	R AND R DRAWBAR TORQUED AND TORQUE STRIP ALL HARDWARE NEW A CAR ASS#419566(SN:179) NEW B CAR ASS#406479(SN:086)						
Component:	000-300-L11-002 DRAWBAR, SEMIPERMANENT, REAR, A-CAR; DRAWBAR; 7K	**Work Accomp:**	REPLACED REBUILT	**Reason:** INCIDENT//ACCIDENT	**Status:** COMP	**Position:**	**Warranty?:** N
30	damage brackets r and r of damaged car to car brackets						
Component:	000-300-L00 SUBSYSTEM; COUPLER & DRAWBAR/ DRAFT GEAR	**Work Accomp:**	REPAIRED	**Reason:** DAMAGED	**Status:** COMP	**Position:** 232	**Warranty?:** N
40	SEE DETAIL REMOVED AND REPLACED HSB CONTROL PANAL. REPROGRAMING LPSU. RESET WW 27.97.						
Component:	000-300-D06 PROPULSION: COMMON CASE; PCC; 2K/3K/6K	**Work Accomp:**	REPLACED USED	**Reason:** INOPERATIVE	**Status:** COMP	**Position:** 246	**Warranty?:** N
50	R/R AIRLINE FILTER						
Component:	000-300-L02-008 AIRLINE FILTER; 5K/6K	**Work Accomp:**	REPLACED NEW	**Reason:** TIME CHANGE OUT	**Status:** COMP	**Position:** 246	**Warranty?:** N

Planned Materials

Task ID	Item	Description	Storeroom	Issue Unit	Quantity	Unit Cost	Line Cost
	M18317117	PANEL,CONTROL:HSCB,6K,PROPULSION	200	EA	1	$0.00	$0.00

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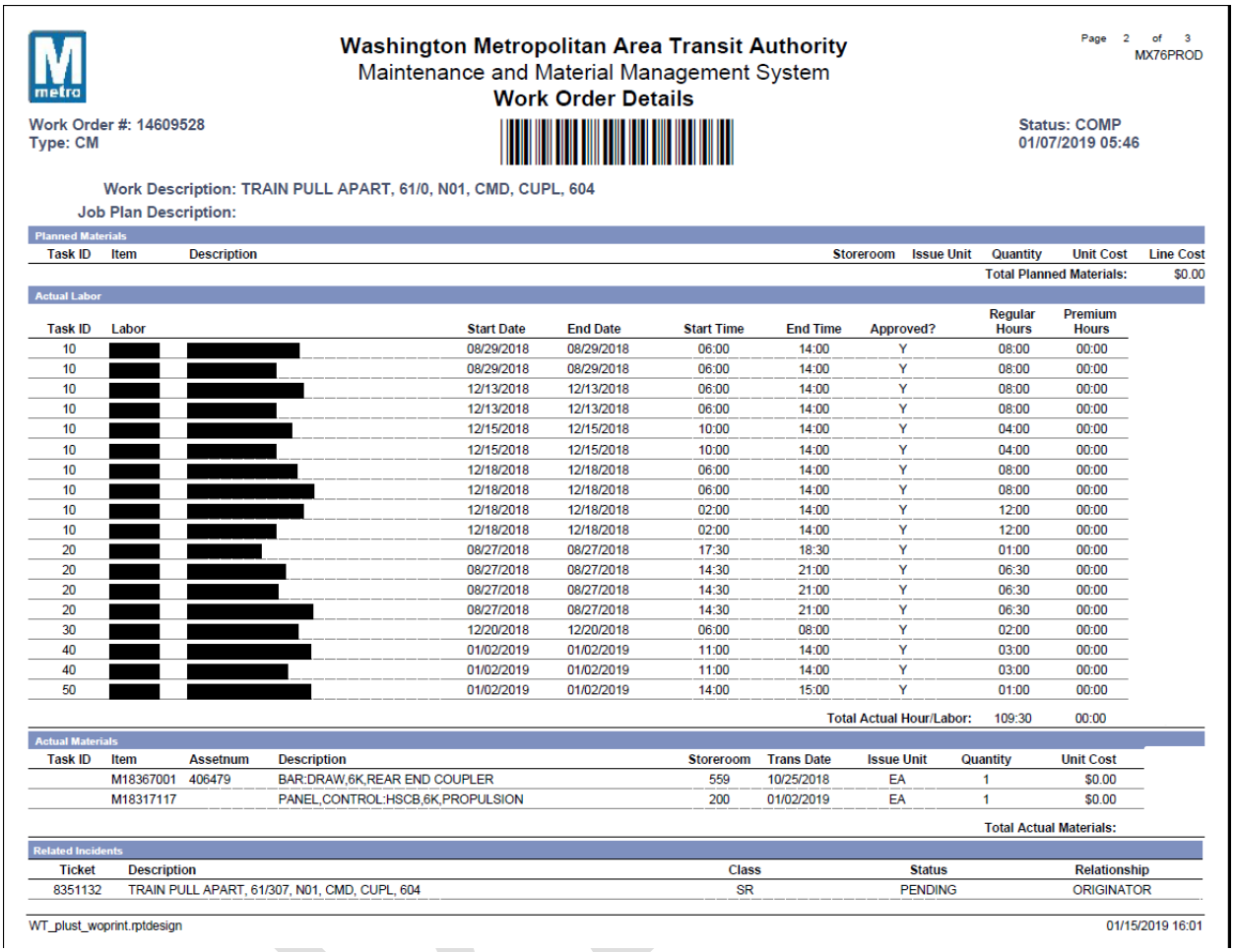
Attachment 5 – Repair Work-order 14609528 for Car 6039 page 1 of 3

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019



Washington Metropolitan Area Transit Authority
Maintenance and Material Management System
Work Order Details

Work Order #: 14609528
Type: CM

Status: COMP
01/07/2019 05:46

Work Description: TRAIN PULL APART, 61/0, N01, CMD, CUPL, 604
Job Plan Description:

Planned Materials

Task ID	Item	Description	Storeroom	Issue Unit	Quantity	Unit Cost	Line Cost
					Total Planned Materials:		$0.00

Actual Labor

Task ID	Labor		Start Date	End Date	Start Time	End Time	Approved?	Regular Hours	Premium Hours
10	[redacted]	[redacted]	08/29/2018	08/29/2018	06:00	14:00	Y	08:00	00:00
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10	[redacted]	[redacted]	12/18/2018	12/18/2018	02:00	14:00	Y	12:00	00:00
20	[redacted]	[redacted]	08/27/2018	08/27/2018	17:30	18:30	Y	01:00	00:00
20	[redacted]	[redacted]	08/27/2018	08/27/2018	14:30	21:00	Y	06:30	00:00
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20	[redacted]	[redacted]	08/27/2018	08/27/2018	14:30	21:00	Y	06:30	00:00
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40	[redacted]	[redacted]	01/02/2019	01/02/2019	11:00	14:00	Y	03:00	00:00
40	[redacted]	[redacted]	01/02/2019	01/02/2019	11:00	14:00	Y	03:00	00:00
50	[redacted]	[redacted]	01/02/2019	01/02/2019	14:00	15:00	Y	01:00	00:00
						Total Actual Hour/Labor:		109:30	00:00

Actual Materials

Task ID	Item	Assetnum	Description	Storeroom	Trans Date	Issue Unit	Quantity	Unit Cost
	M18367001	406479	BAR:DRAW,6K,REAR END COUPLER	559	10/25/2018	EA	1	$0.00
	M18317117		PANEL,CONTROL:HSCB,6K,PROPULSION	200	01/02/2019	EA	1	$0.00
							Total Actual Materials:	

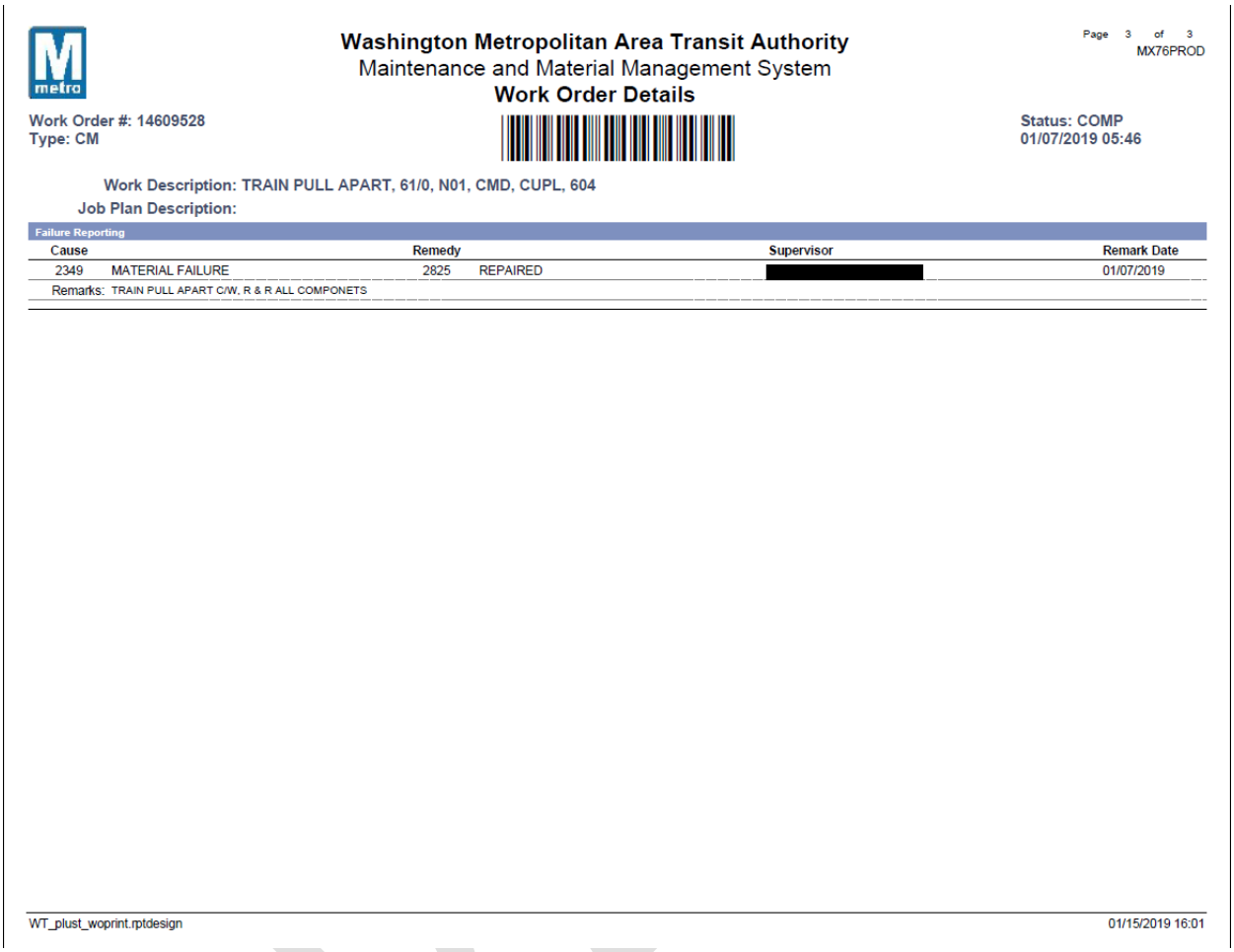
Related Incidents

Ticket	Description	Class	Status	Relationship
8351132	TRAIN PULL APART, 61/307, N01, CMD, CUPL, 604	SR	PENDING	ORIGINATOR

WT_plust_woprint.rptdesign 01/15/2019 16:01

Attachment 5 – Repair Work-order 14609528 for Car 6039 page 2 of 3

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019



Washington Metropolitan Area Transit Authority
Maintenance and Material Management System
Work Order Details

Page 3 of 3
MX76PROD

Work Order #: 14609528
Type: CM

Status: COMP
01/07/2019 05:46

Work Description: TRAIN PULL APART, 61/0, N01, CMD, CUPL, 604
Job Plan Description:

Failure Reporting

Cause		Remedy		Supervisor	Remark Date
2349	MATERIAL FAILURE	2825	REPAIRED	[redacted]	01/07/2019
Remarks:	TRAIN PULL APART C/W, R & R ALL COMPONETS				

WT_plust_woprint.rptdesign 01/15/2019 16:01

Attachment 5 – Repair Work-order 14609528 for Car 6039 page 3 of 3

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

Washington Metropolitan Area Transit Authority

CENV

Incident Report

McLean Station Pull Apart

August 28, 2018

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

Washington Area Metropolitan Transit Authority

Incident Summary Report

Table of Contents

Attachment 6 – CENV investigative report page 2 of 13

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

LOCATION:	McLean Station
INCIDENT #:	8351132
DATE:	08/25/2018
TIME:	10:41 AM

Attachment 6 – CENV investigative report page 3 of 13

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

Executive Summary

On August 25, 2018; at approximately 10:41 a.m., revenue Train ID # 604 (L 6141/40 x 6178/79 x 6039/38 x 6081/80 T) traveling inbound (toward East Falls Church station), on Track 1 of the Silver Line, experienced a "Pull Apart", between cars 6038 and 6039 (i.e. between A and B cars of the married pair). The Rear-end coupler (drawbar) was pulled apart, just past McLean Station (N01) at CM636+68.

CMNT, SAFE, RTRA, and CENV responded to the incident.

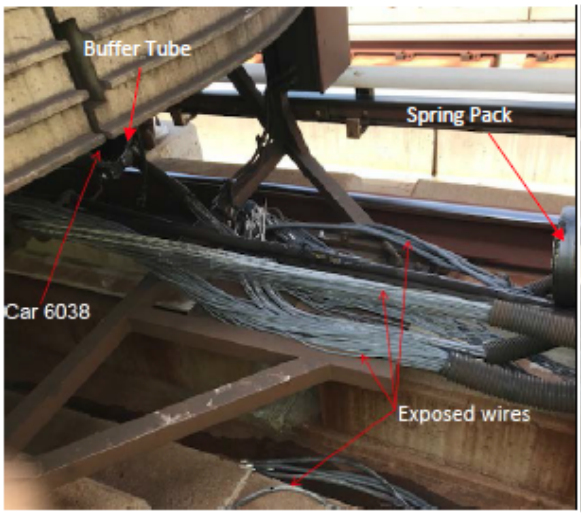


Figure 1a – Car 6038 - View of pull apart (Buffer Tube and exposed car to car wire)

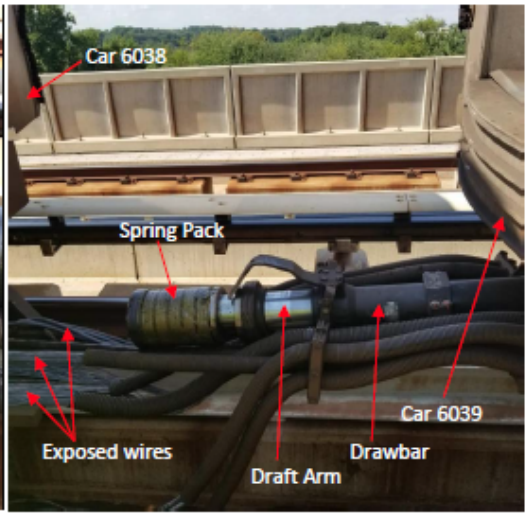


Figure 1b – Car 6039 – View of pull apart (Exposed car to car wire, Spring Pack & Drawbar)

The root cause of the pull apart was not apparent from the initial observations (which are provided on page 7). After performing the on-site investigation, it was decided that, the cars would be taken to the West Falls Church S&I, where the Buffer Tube/Drawbar assembly would be removed from the car and shipped to the MRO shop, for further analysis.

Once power was restored to the Lead car (6141), the VMS data was downloaded and analyzed (see page 8 for results of the analysis).

The inspection/testing of the Buffer Tube/Drawbar assembly continued the morning of 8/26 at the Greenbelt MRO Coupler Shop (see page 10 for details). The root cause of the pull apart is determined to be inadequate clamping force caused by damaged threads on the Buffer Tube Locking screw (Fig 11) and nut. The threads were damaged due to galling which was caused by excessive heat, generated due to use of power tool.

Attachment 6 – CENV investigative report page 4 of 13

Figure 2 – Buffer tube (Car 6038)

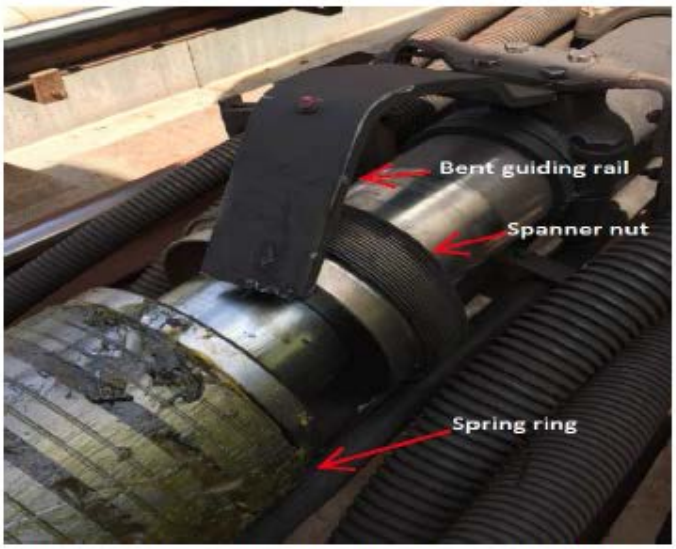


Figure 3 – Bent guiding rail and Ring spring (Car 6039)

Attachment 6 – CENV investigative report page 5 of 13

Figure 4 – Damaged Upper cable mount bracket (Car 6039)

Figure 5 – Only last thread was damaged on Buffer tube (Car 6038)

Attachment 6 – CENV investigative report page 6 of 13

Investigation

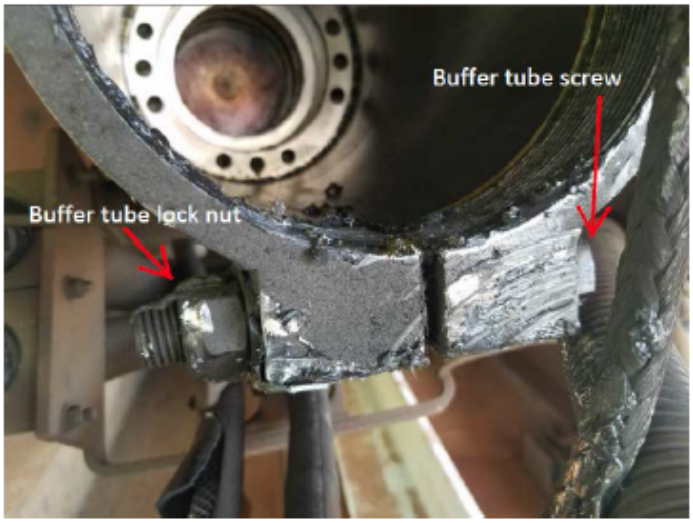


Figure 6 – Buffer tube, screw and lock nut

Upon notification, CENV responded to the incident.

CENV was granted access to the incident site after the safety briefing was conducted by CMNT. Below is a list of initial the observations:

1. The Train ID # 604 was found on track # 1 leaving McLean station heading towards the East Falls Church Station.
2. All cars were on the running rail with the 3rd Rail energized.
3. The draft arm portion of the drawbar had been completely removed from the Buffer tube.
4. The train dumped (emergency brake applied).
5. The Buffer tube was attached to car 6038 and the draft arm was connected to car 6039.
6. The Buffer tube lock screw and nut were intact (Fig. 6).
7. The Buffer tube threads were dirty but not damaged, except for the last (outer) thread, (Fig. 5).
8. The car mounted portion of the semi-permanent coupler (cars 6038 & 6039) were both intact.
9. The guiding rail which was mounted on the drawbar of 6039 was bent (Fig. 3).
10. The car to car jumper wire support, mounted on 6039's drawbar was damaged, (Fig 4).
11. Some of the car to car jumper wires were ripped apart (Fig. 1)
12. The inter-car pneumatic lines were not separated from the cars
13. The cars were separated approximately 20ft from each other and taken separately to West Falls Church shop for further inspection and repairs.

Attachment 6 – CENV investigative report page 7 of 13

VMS data from Lead Car 6140 was downloaded and analyzed.

VMS Analysis

Train ID # 604 left McLean metro station on track # 1 at 10:30:15 and traveled 1867ft before dumping the brake pipe at CM636+68 at a speed of approximately 44MPH. The train travelled an additional 265ft before coming to a complete stop at Chain marker CM634+03 at 10:31:11, see figure 7

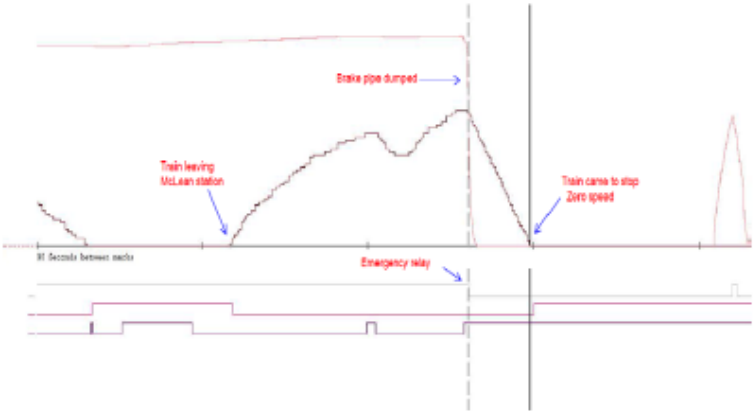


Figure 7 – Leaving McLean station, Brake Pipe Dumped – Emergency Brake applied

The operator attempted to recharge the pipe beginning at 10:31:43, during which the pressure reached 86.43psi, but was unable to maintain air pressure. The operator made a 2nd and a 3rd unsuccessful recharge attempt at 10:32:25 and 10:32:59 respectively, see Figure 8.

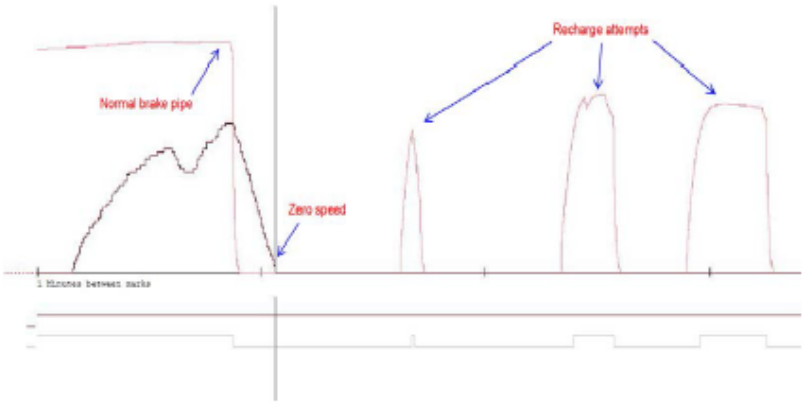


Figure 8 – Recharge attempts

Attachment 6 – CENV investigative report page 8 of 13

ID # 604 was keyed down at 10:34:54 then keyed back up at 10:36:18 to recharge the brake pipe one last time at 10:36:23, see Figure 9.

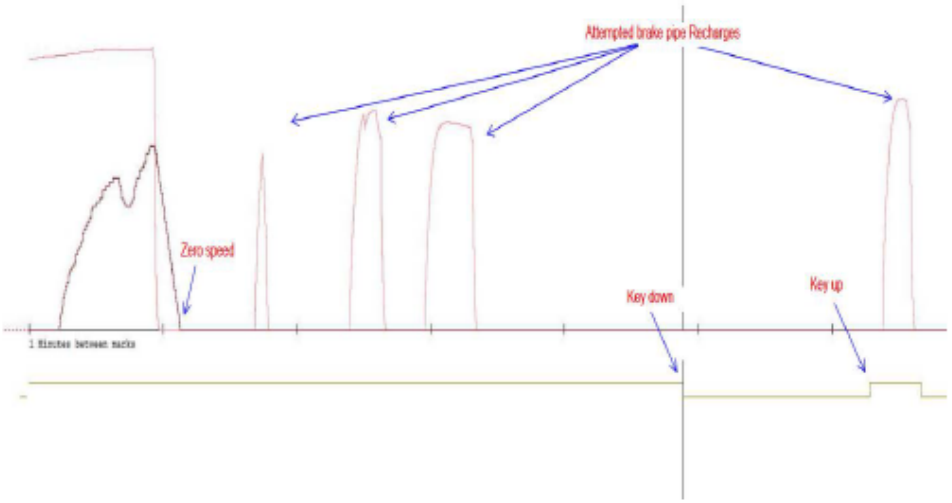


Figure 9 –Train key down / up and recharge

Overhaul Shop Inspection and Testing

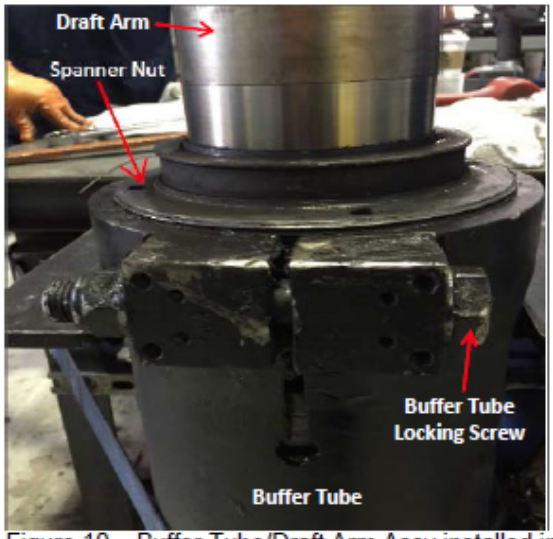


Figure 10 – Buffer Tube/Draft Arm Assy installed in MRO shop rebuild fixture

The semi-permanent coupler of 6038, the associated Buffer tube and the Drawbar/Draft bar assembly (from 6039) were removed and transported to the overhaul shop for further analysis and testing. The tube was placed in the MRO shop rebuild fixture, where the draft bar was inserted (into the Buffer tube) and the spanner nut screwed in, without loosening the Buffer Tube locking screw and nut, (Fig 10). During the next step of the testing, it was discovered that the lock screw and nut were moving freely. After removing the lock nut and screw, the screw threads were found with signs of galling which were consistent with that of a cross-threaded bolt, (Fig. 11). Although it was demonstrated that the torque of the locking screw exceeded the required 226 ft-lbs, the cross-threads provided a false reading. The false reading resulted in a torque value which was less than the required value and ultimately resulted in a reduced clamping force (of the buffer tube), which allowed the spanner nut to back out over time.

Figure 11a – Cross Threaded Buffer tube lock Screw

Figure 11b – Cross Threaded Buffer tube lock Screw

An investigation of the tube lock screw shows that the installed A4 – 70 screw (bolt) does not match any available WMATA documentation. Per OEM documentation the correct screw is A4-80 (Deller P/N: 5016020150, WMATA P/N: C18-36-6091). See Figure 12.

Incorrect A4-70 screw Correct A4-80 screw

Figure 12 – A4-70 and A4-80 Locking Screws

Additional Findings

Further investigations revealed that an incorrect bolt (zinc plated, GR 10.9) was in stock under P/N: C18-36-6091. See Figure 13. This is due to an incorrect part description within Windchill.

Figure 13 – Incorrect Zinc Plated bolts. Found in stock room under C18-36-6091 (& C18-36-6051)

Actions Taken

- The incorrect zinc plated bolts, mentioned above, were removed from stock and the part description corrected within Windchill.
- Fleet wide inspection (of 5K & 6K) was performed to ensure…
  - Proper hardware (i.e. A4-80 bolt) was used
  - Spanner Nut was properly installed (maximum one thread visible)
  - Torque Stripe was applied to the Buffer Tube screw
    - If torque stripe was found missing, ensure screw, nut & washer assembly cannot rotate. If assembly rotates, hardware was removed, replaced and properly torqued
  - FINDINGS:
    - 70 screws found with either no torque stripe or torque stripe not visible
      - Torque stripe was applied to screws prior to cars being released for service
    - 8 units found where screw, nut & washer assembly were able to rotate
      - Hardware was replaced prior to cars being released for service
    - 8 Spanner Nuts found not flush with Buffer Tube
      - Additional inspection performed and Spanner nuts were tightened as needed
- A4-70 bolt has been sent to test lab to determine cause of failure. Please see enclosed lab report.

Conclusion

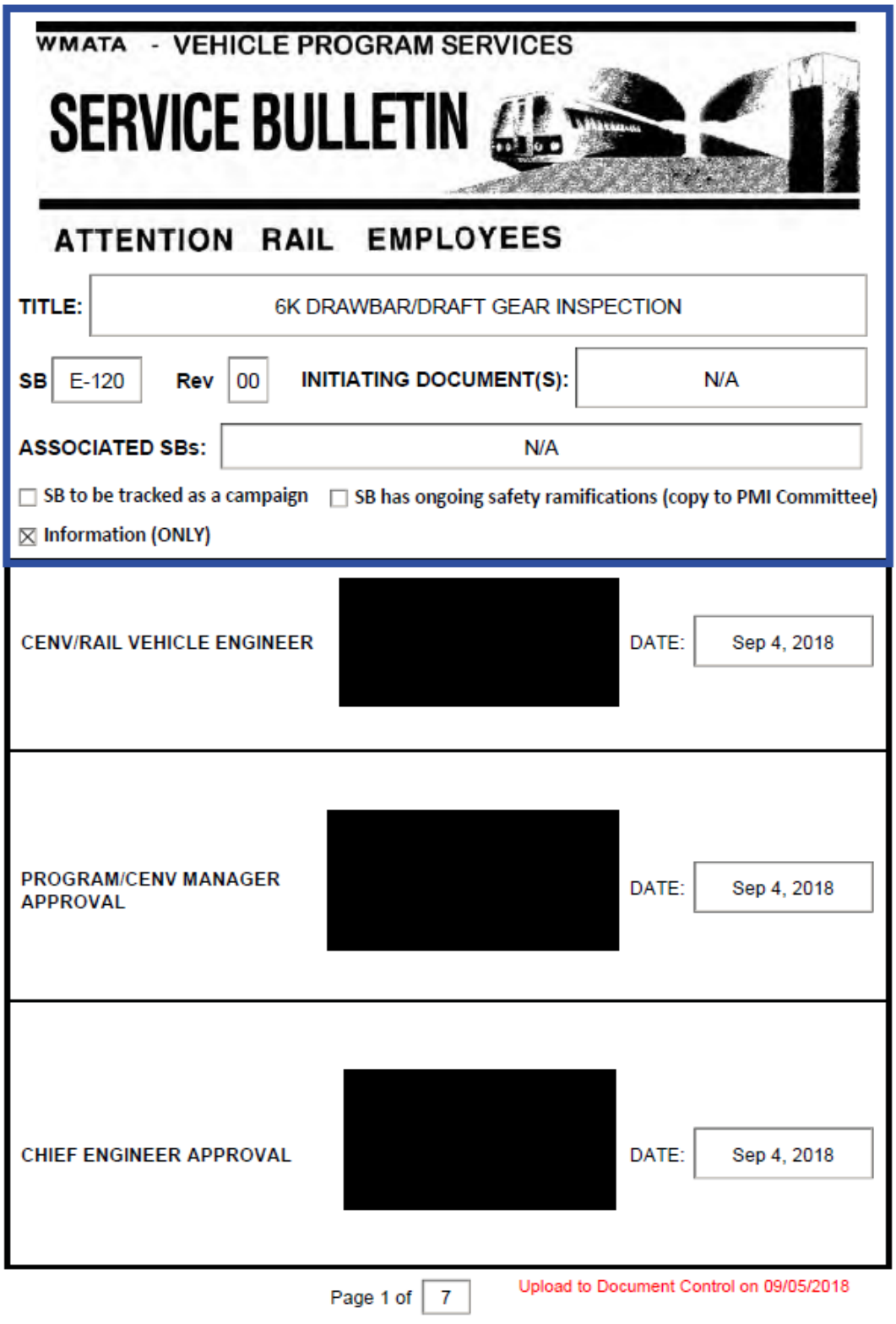
The investigation of the pull apart of Train ID # 604 (Cars 6038 - 6039), culminated with the finding of stripped threads on the Buffer Tube Locking screw. The stripped threads provided a false torque reading. The false torque reading led to a reduced clamping force of the buffer tube, which is designed to lock the spanner nut in position. Insufficient clamping force allowed the spanner nut to slowly back out over time, which led to the draft arm (and spring pack) being pulled out of the buffer tube, consequently causing the incident where the cars separated.

The stripping of the threads was caused by extensive heat generated due to the use of power tools.

Recommendations

- CMO to issue written instructions to CMNT prohibiting use of power tools when installing bolts.
- CENV to issue formal Service Bulletin (SBE 120) authorizing inspection of 5K/6K Drawbar/Draft Gear assembly

ALWAYS CHECK SOURCE DOCUMENT FOR CURRENT REVISION



WMATA - VEHICLE PROGRAM SERVICES

SERVICE BULLETIN

ATTENTION RAIL EMPLOYEES

TITLE: 6K DRAWBAR/DRAFT GEAR INSPECTION

SB E-120 **Rev** 00 **INITIATING DOCUMENT(S):** N/A

ASSOCIATED SBs: N/A

☐ SB to be tracked as a campaign ☐ SB has ongoing safety ramifications (copy to PMI Committee)

☒ Information (ONLY)

CENV/RAIL VEHICLE ENGINEER	[redacted]	DATE: Sep 4, 2018
PROGRAM/CENV MANAGER APPROVAL	[redacted]	DATE: Sep 4, 2018
CHIEF ENGINEER APPROVAL	[redacted]	DATE: Sep 4, 2018

Page 1 of 7

Upload to Document Control on 09/05/2018

Attachment 7 – CENV SBE 120 Drawbar/Draft Gear Inspection page 1 of 7

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

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WMATA - VEHICLE PROGRAM SERVICES

SERVICE BULLETIN

ATTENTION RAIL EMPLOYEES

DRAWBAR/DRAFT GEAR INSPECTION ALSTOM 6000 SERIES RAILCARS	SBE-120 Rev 00

IMPORTANT: This Service Bulletin is being issued to authorize the immediate inspection of the 6K Drawbar/Draft Gear assembly.

1.0 INSPECTION OF THE PROPER BOLTS/HARDWARE USED

1. Inspect the coupler tube bolt (C18-36-6091) to ensure the head of the bolt is stamped with the Information shown in the figure below, A4 - 80.

Attachment 7 – CENV SBE 120 Drawbar/Draft Gear Inspection page 2 of 7

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

ALWAYS CHECK SOURCE DOCUMENT FOR CURRENT REVISION

WMATA - VEHICLE PROGRAM SERVICES

SERVICE BULLETIN

ATTENTION RAIL EMPLOYEES

DRAWBAR/DRAFT GEAR INSPECTION ALSTOM 6000 SERIES RAILCARS	SBE-120 Rev 00

2. If the markings on the head of the bolt are not the same, all of the hardware: Bolt, washers and nut shall be replaced.
3. Inspect the clamping bolt (C18-36-6051) to ensure the head of the bolt is stamped with the Information shown in the figure above, A4 - 80.
4. If the markings on the head of the bolt are not the same (A4 – 80), all of the hardware: Bolt, washers and nut shall be replaced.

Attachment 7 – CENV SBE 120 Drawbar/Draft Gear Inspection page 3 of 7

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

WMATA - VEHICLE PROGRAM SERVICES

SERVICE BULLETIN

ATTENTION RAIL EMPLOYEES

DRAWBAR/DRAFT GEAR INSPECTION ALSTOM 6000 SERIES RAILCARS	SBE-120 Rev 00

2.0 INSPECTION OF THE GLAND NUT SEATING

IMPORTANT: This inspection has been expanded to include the 20 remaining 5000 series vehicles that are available for revenue service.

1. Ensure (Gland) nut is properly mounted e.g., one thread maximum can be visible with the face of the coupler, as indicated in Figure 1 below.

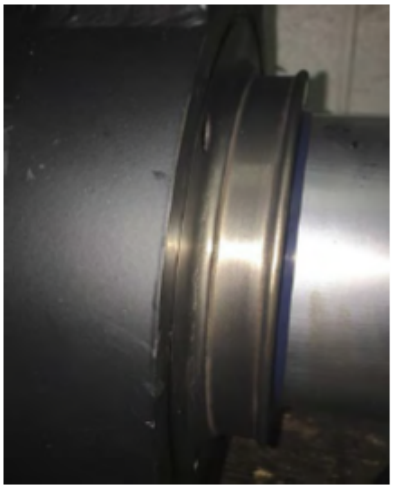


Figure 1.

Page 4 of 7

Attachment 7 – CENV SBE 120 Drawbar/Draft Gear Inspection page 4 of 7

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

WMATA - VEHICLE PROGRAM SERVICES

SERVICE BULLETIN

ATTENTION RAIL EMPLOYEES

DRAWBAR/DRAFT GEAR INSPECTION ALSTOM 6000 SERIES RAILCARS	SBE-120 Rev 00

2. Any (Gland) nut inspected and found to have more than one thread showing, the (Gland) nut shall be re-inspected by the on-duty Supervisor.
3. If the on-duty Supervisor determines the (Gland) nut to be more than one thread out, the rail vehicle shall be taken out-of-service.
4. A Maximo work order shall be opened to document any discrepancies found and all the repair work performed.
5. If the (Gland) nut is properly installed, ensure torque stripe is applied to the coupler tube bolt (C18-36-6091), lock nut (C18-36-6087) and washer (C18-36-6089) as shown in 2.

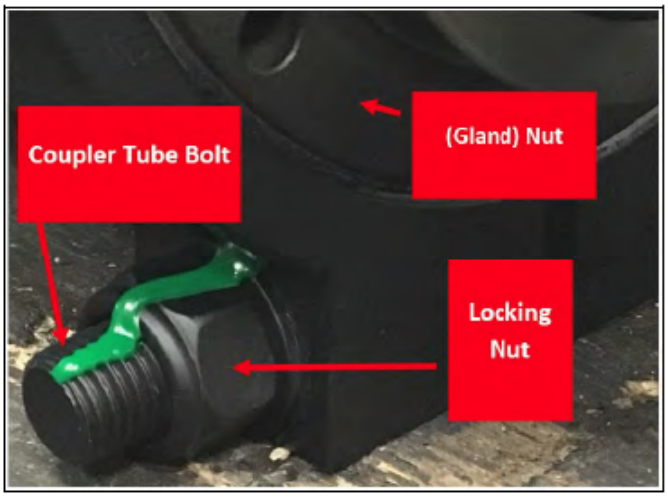


Figure 2.

Page 5 of 7

Attachment 7 – CENV SBE 120 Drawbar/Draft Gear Inspection page 5 of 7

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

WMATA - VEHICLE PROGRAM SERVICES

SERVICE BULLETIN

ATTENTION RAIL EMPLOYEES

DRAWBAR/DRAFT GEAR INSPECTION ALSTOM 6000 SERIES RAILCARS	SBE-120 Rev 00

6. If no torque stripe is visible and/or is broken, place a wrench on the bolt head to determine if the bolt assembly can rotate, figure 3.

Figure 3.

7. If the bolt assembly can be rotated, the nut shall be re-torqued to 226 ft-lbs.
8. After the torque is applied, place a wrench on the bolt head to determine if the bolt assembly can rotate, figure 3.
9. If rotation of the bolt assembly is noticed after the torque is applied, all the hardware MUST be changed out and/or the vehicle shall remain OOS.

Page 6 of 7

Attachment 7 – CENV SBE 120 Drawbar/Draft Gear Inspection page 6 of 7

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

WMATA - VEHICLE PROGRAM SERVICES

SERVICE BULLETIN

ATTENTION RAIL EMPLOYEES

DRAWBAR/DRAFT GEAR INSPECTION ALSTOM 6000 SERIES RAILCARS	SBE-120 Rev 00

IMPORTANT: An in-progress quality control inspection MUST be performed during the installation of the new hardware.

10. When installing new hardware follow the appropriate steps as outlined in the corresponding MSI.
11. If rotation is NOT noticed after the torque is applied, ensure torque stripe is applied to the coupler tube bolt (C18-36-6091), lock nut (C18-36-6087) and washer (C18-36-6089) as shown in figure 2.
12. Place a bolt, nut and two washers on order against the vehicle's PI shop storeroom for future replacement when the hardware arrives.

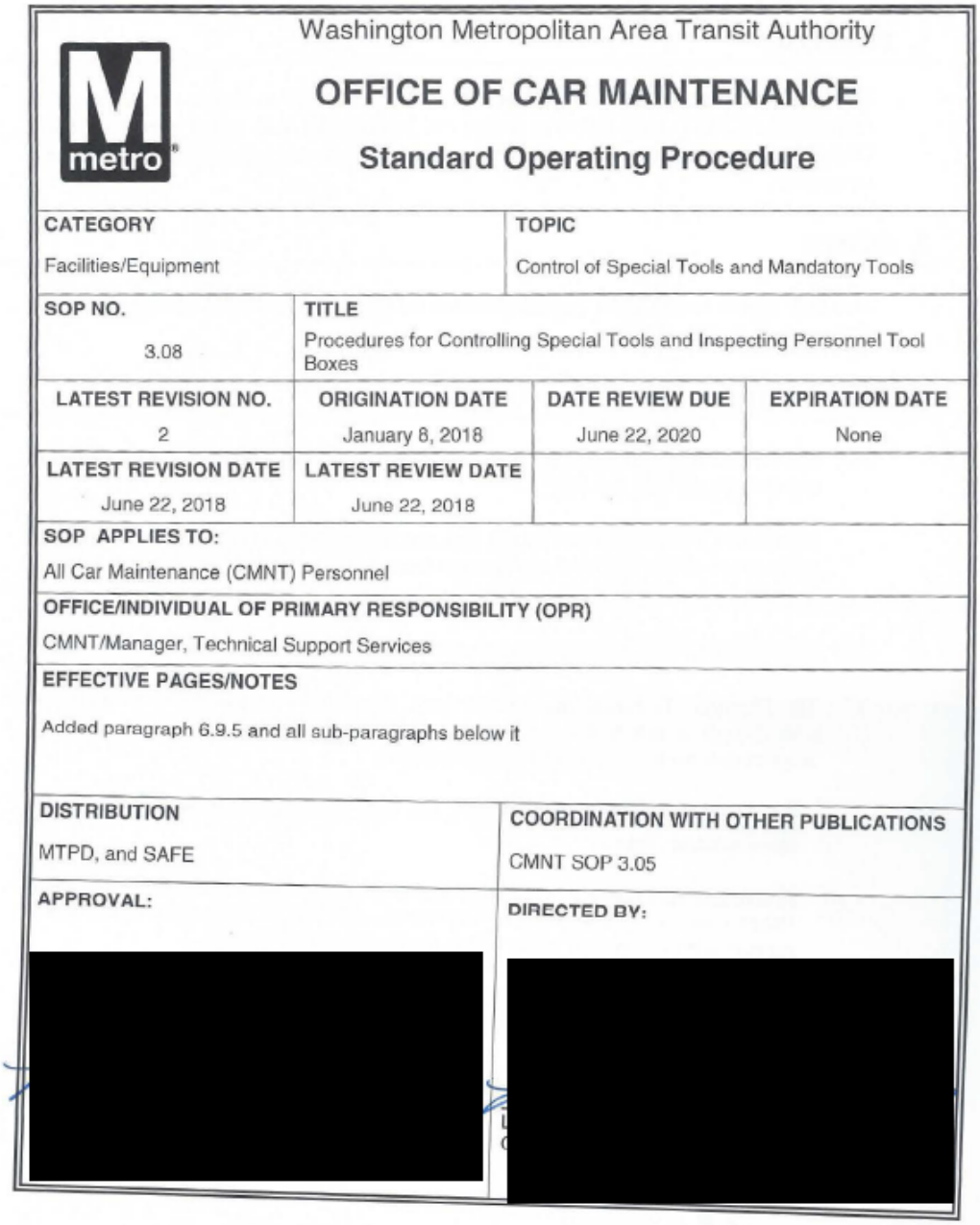
NOTICE: Once the hardware above arrives at the PI shop location, it's that PI block Supervisor responsibility to ensure the hardware is installed at the earliest convenience e.g., unscheduled maintenance opportunity or the next scheduled maintenance performed on the vehicle.

13. The Maximo work order shall reflect all maintenance actions performed.

Page 7 of 7

Attachment 7 – CENV SBE 120 Drawbar/Draft Gear Inspection page 7 of 7

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019



Washington Metropolitan Area Transit Authority

OFFICE OF CAR MAINTENANCE

Standard Operating Procedure

CATEGORY	TOPIC
Facilities/Equipment	Control of Special Tools and Mandatory Tools

SOP NO.	TITLE
3.08	Procedures for Controlling Special Tools and Inspecting Personnel Tool Boxes

LATEST REVISION NO.	ORIGINATION DATE	DATE REVIEW DUE	EXPIRATION DATE
2	January 8, 2018	June 22, 2020	None
LATEST REVISION DATE	**LATEST REVIEW DATE**		
June 22, 2018	June 22, 2018		

SOP APPLIES TO:

All Car Maintenance (CMNT) Personnel

OFFICE/INDIVIDUAL OF PRIMARY RESPONSIBILITY (OPR)

CMNT/Manager, Technical Support Services

EFFECTIVE PAGES/NOTES

Added paragraph 6.9.5 and all sub-paragraphs below it

DISTRIBUTION	COORDINATION WITH OTHER PUBLICATIONS
MTPD, and SAFE	CMNT SOP 3.05

APPROVAL: [redacted]

DIRECTED BY: [redacted]

SOP 3.08, Rev. 2

Approved 06/22/2018

Moved to Document Control 06-22-2018

Attachment 8 – CMNT Written instruction SOP 3.08

Drafted By: SAFE 704 – 04/19/2019
Reviewed By: SAFE 701 – 04/29/2019
Approved By: SAFE 70 – 05/24/2019

Lehigh Testing Laboratories, Inc.
A Subsidiary of THE MMR GROUP, INC.
[redacted]
www.LehighTesting.com
THE MMR GROUP, INC. an ESOP Company

September 26, 2018

[redacted]
WMATA – Greenbelt Yard
[redacted]

SUBJECT: Evaluation of 3/4" Bolt with Nut
LTK PO 20853
Lehigh Project No. 3285-18/MMR Project No. 124209

Dear [redacted]

A 3/4" bolt and nut was submitted to Lehigh Testing Laboratories, Inc. to perform an analysis to determine why the damage occurred.

The evaluation was subcontracted to our sister lab, Massachusetts Materials Research, Inc. (MMR). The analysis was performed by [redacted] Senior Materials Engineer at Massachusetts Materials Research, Inc.

Their report is attached.

Any technical questions you can contact [redacted] at [redacted] or if you prefer contact me and I will forward your requests.

Thank you for giving us the opportunity to assist you in this investigation.

Regards,

LEHIGH TESTING LABORATORIES, INC.

[redacted]
[redacted]

Attach.

Attachment 9 – Leigh Testing Laboratories Report page 1 of 6

BACKGROUND

A bolt from a semi-permanent coupler arrangement used by the Washington Metro Area Transit Authority (WMATA) exhibited severe thread damage. It was requested that Massachusetts Materials Research, Inc. (MMR) examine the bolt and its associated nut to determine why the damage occurred. The bolt was reportedly installed using power equipment.

The bolt and nut were examined visually and with a binocular microscope as-received. Multiple other tests were originally planned (i.e. chemical analysis, tensile testing, metallurgical examination, etc.), but were found to be unnecessary upon completion of binocular microscopy.

RESULTS

Visual and Binocular Microscope Examinations

The bolt is shown as-received in Figures 1 and 2. The bolt head was marked THE and A4-70. The THE marking is the manufacturer's mark. The A4-70 indicates a stainless steel bolt of strength class 70 (cold worked 300-series stainless similar to Type 316). Checking both bolt and nut with a magnet revealed neither was magnetic. This is consistent with construction of both items from a 300-series stainless steel.

Examination of the threads of the bolt revealed severe material movement, thread shearing, and some small regions of heat tint, Figures 3 through 6. Damage to the nut threads was similar, Figure 7. Aligning the nut with the extent of the bolt thread damage revealed that over ½-inch of the bolt thread damage was visible to the installer, Figure 8. The damage to both items was consistent with galling. Type 316 and other 300-series stainless steels are known to gall readily when self-mated or similarly mated. According to the Industrial Fasteners Institute (IFI), high speed fastener installation contributes to galling due to the heat generated during such assembly. Low speed wrench can help mitigate or prevent galling, as can use of lubricants containing substantial amounts of molybdenum disulfide, graphite, mica, or talc. Some proprietary extreme pressure waxes and greases can also be used to mitigate the problem.

CONCLUSIONS

The thread damage exhibited by both bolt and nut was consistent with galling. The 300-series stainless steels are known to exhibit a propensity to gall when self-mated or similarly mated. While rolled threads can help mitigate the problem, they will not prevent it. Heat generated during the use of power equipment during installation of such fasteners can lead to severe galling and is not recommended for stainless steel fastener hardware. If power equipment must be used, lowered speeds are necessary, and may still lead to galling without use of lubrication. Note that use of lubrication can lead to over-torqueing of fastener assemblies. The damage observed precluded the need for chemical analysis, mechanical testing, or metallurgical examination.

Figure 1: Overall view of submitted bolt.

Figure 2: Overall view of thread damage on the submitted bolt.

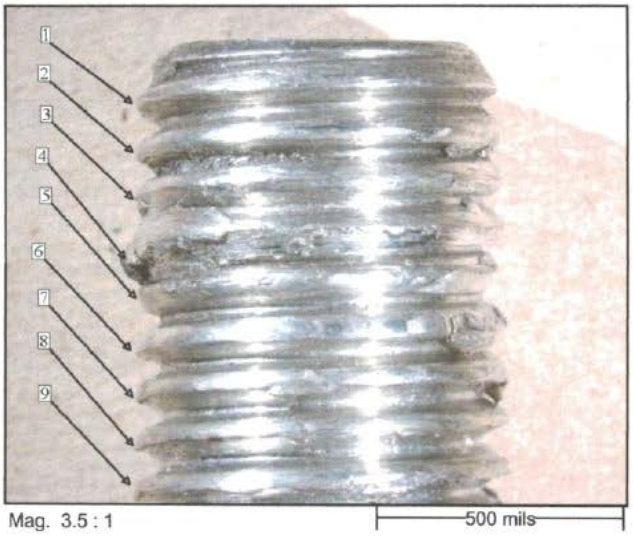


Figure 3: Detail of thread damage on threads 1-9, numbered from terminal end of bolt.

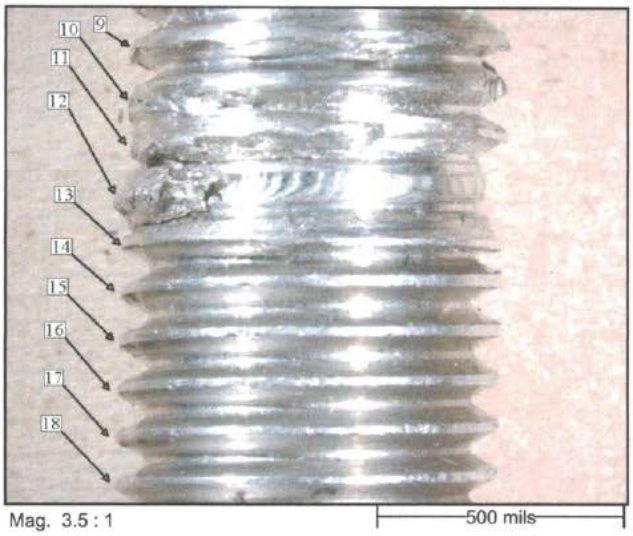


Figure 4: Detail of threads 9-18. Threads 19 and 20 were undamaged.

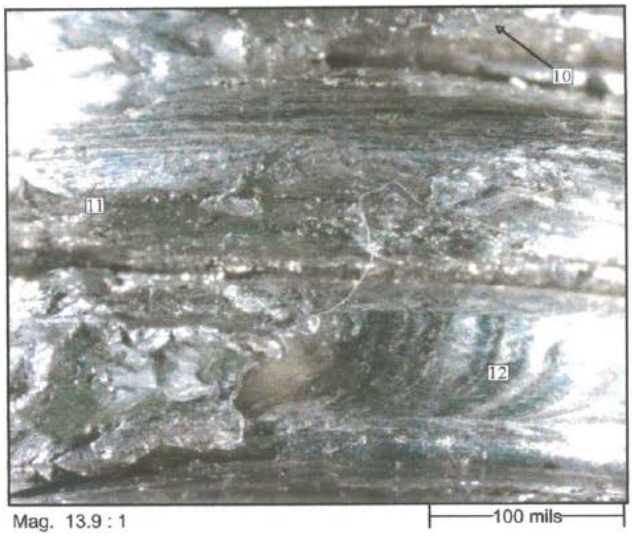


Figure 5: Higher magnification of damage to threads 10-12 showing material movement and thread shearing.

Figure 6: Heat tint on threads 7 and 8, arrows.

Figure 7: The nut threads were damaged in the same way as the bolt threads.

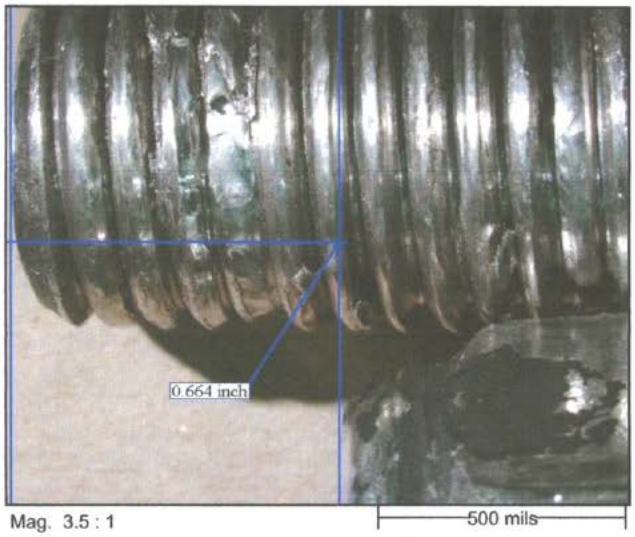


Figure 8: With nut placed at damaged terminus, over ½-inch of thread damage is visible.