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W-0325 & W-0326 Hazardous Materials Spills – Green Line, Red Line – August 9, 2023

Document Purpose

This WMSC written report on WMATA Metrorail's safety event investigation and review of Metrorail's findings in accordance with the WMSC Program Standard, in conjunction with the attached Metrorail investigation reports that have undergone WMSC staff review, feedback, and Metrorail revision, describes the investigation activities, identifies factors causing or contributing to the accident, and sets forth ongoing, additional, or upcoming corrective actions and further oversight work (such as inspections and audits) as necessary or appropriate. The WMSC's ongoing oversight during the investigative process, including safety event reporting and verification, participation in investigative interviews, data review, consistent communication with the Metrorail investigations team, and feedback on Metrorail's reports leads to further improvements prior to consideration of the reports by WMSC Commissioners for adoption. The WMSC's safety event investigation oversight assures the sufficiency and thoroughness of Metrorail's investigations. The WMSC Commissioners are considering these documents (the WMSC review and Metrorail's investigation report) as a unified item for adoption at the Washington Metrorail Safety Commission meeting on August 6, 2024.

WMSC staff recommend adoption of these investigations.

Safety event summaries:

The two hazardous materials spills on August 9, 2023 were separate events, each related to a hydraulic fluid spill. Metrorail combined the two hazardous materials spills investigations into a single Metrorail investigation report due to the separate events occurring on the same day and requiring related investigative activities. One event relates to the use of a hydraulic hose that Metrorail made and installed of the improper length. The other relates to the failure of an internal seal in a boom.

The causes of and contributing factors to these events include:

- Metrorail not following industry standard practices for hydraulic hose installation
- Insufficient spill containment materials
- The failure of a rubber seal

As a result of these investigations, Metrorail developed the following corrective actions:

- Metrorail created large spill response kits to have available for significant leak/spill events.
- Metrorail's vehicle engineering will ensure hydraulic hoses are rerouted on tamper units to meet industry standard slack of 2% to –4% during each tamper's preventive maintenance inspection.
- Metrorail inspected tamper units for safety issues such as weeping at the fittings. This inspection did not identify any other precursors of hydraulic safety issues. All three tampers on Metrorail property are now in service. Metrorail verbally instructed mechanics to pay additional attention to hoses identified for replacement until they are replaced.
- Metrorail's vehicle engineering is including consideration of hydraulic hose failures in consideration of trending safety issues.

Related Open CAPs

- C-0241 addressing the finding that Metrorail is not effectively tracking and mitigating hazards related to Roadway Maintenance Machine (RMM) maintenance and operations in accordance with its PTASP
- C-0244 addressing the finding that Metrorail is not reviewing its RMM-related procedures as required.

W-0325 – Track tamping machine hydraulic hose bursts while in use on Green Line (WMATA ID: E23550)

An improper length hydraulic hose created by Metrorail maintenance personnel and installed on a Metro 4X4 track tamping machine (T004) broke while the RMM was in use in a Green Line work area between Greenbelt and College Park stations. This led to a spill of approximately 200 gallons of hydraulic fluid.

After the hose failed, workers could not cap the line due to the high temperature that developed while the machine was in use. The fluid spilled onto ballast and down an embankment. Personnel placed spill booms and absorbent pads.

Metrorail concluded that the fluid did not reach the adjacent concrete channel, and had no environmental impact. The contaminated ballast was removed and replaced. Metrorail reported the spill to the Maryland Department of the Environment, which is required for a spill of this type.

The event occurred in a long-term shutdown area. This event was not communicated over any recorded radio channels.

The vehicle is scheduled to be inspected every 120 days. It was approximately halfway between its periodic inspections.

The investigation demonstrated that Metrorail did not follow industry standards for straight hose installation. These standards require slack in the hose line to account for changes in length when pressure is applied. This slack was not provided, therefore the pressure led to the hose failing.

W-0326 – Hydraulic failure upon activation of RMM boom at Medical Center Station (WMATA ID: E23551)

A rental work vehicle that has been in use at Metrorail for more than five years, Prime Mover 578, leaked an estimated 10 to 20 gallons of hydraulic fluid at Medical Center Station as the crane boom was being moved above the flatcar for later offloading of material.

When the boom was moved upward, personnel observed a leak from a hose attached to the boom. The leak did not continue after the crane was lowered and secured. Personnel utilized the onboard spill kit. A rubber seal on the brake actuator in the winch drum of the crane had failed.

The boom arm is inspected every six months; however, this internal rubber seal is not individually inspected during preventive maintenance. Metrorail has not recorded any other instances of this failure mode.

It is positive that the work crew identified the leak and acted to reduce the scale of the leak, preventing environmental or other contamination.

Washington Metropolitan Area Transit Authority
Department of Safety (SAFE)
Office of Safety Investigations (OSI)

FINAL REPORT OF INVESTIGATION A&I E23550, E23551

Date of Event:	August 9, 2023	August 9, 2023
Type of Event:	I-9; Hazmat Spill	I-9; Hazmat Spill
Incident Time:	00:44 hours	02:10 hours
Location:	Chain Marker (CM) E2 636+00, Track 2	Medical Center Station, Track 1
Time and How received by SAFE:	03:24 hours, Mission Assurance Coordinator (MAC)	03:50 hours, Mission Assurance Coordinator (MAC)
WMSC Notification Time:	02:32 hours	02:59 hours
Responding Safety Officers:	None	None
Rail Vehicle:	Tamper Unit T004	Prime Mover – 578
Injuries:	None	None
Damage:	Hydraulic Hose	Hydraulic Hose
Emergency Responders:	None	None
SMS I/A Incident Number:	20230823#110864	20230823#110865

CM E2 636+00, Track 2 (23550) & Medical Center Station, Track 1 (23551)
Hazmat Spill

August 9, 2023

Table of Contents

Abbreviations and Acronyms

AIMS	Advanced Information Management System
ARS	Audio Recording System
CCTV	Closed-Circuit Television
CM	Chain Marker
CMNT	Car Maintenance
CTEM	Car Track Equipment Maintenance
EMAC	Office of Environmental Management and Compliance
MAC	Mission Assurance Coordinator
MC	Mobile Command
MOC	Maintenance Operations Center
MOR	Metrorail Operating Rulebook
NOAA	National Oceanic and Atmospheric Administration
PICO	Project Implementation & Construction
PMI	Preventative Maintenance Inspection
RBIR	Office of Rail & Bus Infrastructure Rehabilitation Programs
RTC	Rail Traffic Controller
RTRA	Office of Rail Transportation
ROCC	Rail Operations Control Center
SAFE	Department of Safety
SCWL	Supply Chain Warehousing and Logistics
SMS	Safety Measurement System
TRST	Office of Track and Structures
WMATA	Washington Metropolitan Area Transit Authority
WMSC	Washington Metrorail Safety Commission

Executive Summary

**Note that all times listed are approximate and may contain minor variations due to differences between systems of record. **

First Event (23550)

On August 9, 2023, at 00:45 hours, the Mission Assurance Coordinator (MAC) was notified of a hydraulic leak from Metro 4X4 Tamping Machine Unit T004 at Chain Marker (CM) E2 636+00, Track 2. It was estimated that 200 Gallons of hydraulic fluid leaked onto the ballast.

According to the Maintenance Operations Center (MOC) Spill Report and Log, at 00:45 hours, the Mobile Command (MC) notified MOC that 200 gallons of hydraulic fluid leaked from Tamping Unit T004 at CM E2 636+00 in the Green Line shutdown area.

Email reports reflect that the pressure line on the left side vibrator failed. Due to the heat coming from the hose line, personnel were unable to cap the line. Spill Booms and absorbent pads were deployed to contain and clean up the hydraulic fluid. The fluid leaked into the ballasted area and down an embankment towards a concrete channel. The fluid did not enter the concrete channel and had no environmental impact. After the event, the contaminated ballast was removed and replaced.

Tamping Unit T004 hydraulic fluid line was repaired on the scene, the hydraulic tank was re-filled, and the unit was returned to Greenbelt Rail Yard.

The probable cause was a broken hydraulic line. This is due to inadequate installation of the aftermarket hose where there was not enough slack in the hose. The industry standard recommendation for straight hose installation is to allow enough slack (+2% to -4%) in the hose line to provide for changes in length that will occur when pressure is applied. No precursors were noted during the pre-trip inspection. [1]

Second Event (23551)

On August 9, 2023, at 02:35 hours, the MAC was notified of a hydraulic leak from Prime Mover PM-578 at Medical Center Station while headed to Shady Grove Rail Yard. It was estimated that 10 to 20 gallons of hydraulic fluid leaked onto track 1.

According to the MOC Spill Report and Log, at 02:10 hours, Prime Mover PM-578 experienced a hydraulic fluid leak at Medical Center Station (A10) on track 1.

The Office of Rail & Bus Infrastructure Rehabilitation Programs (RBIR) and Project Implementation & Construction (PICO) reported PM-578 was loaded onto the roadway via forklift, and the nightly pre-trip inspection was performed before exiting the yard with the M&M Welding and Fabricator Contractor Equipment Operator, Track and Structures (TRST) Pilot, and TRST Flagman. PM-578 traveled inbound on track 1 and stopped at Medical Center Station (A10) platform. At the platform, the crane boom needed to be reversed and swung around above the flatcar for later offloading of material. When the unloaded boom was actuated upward, personnel

[1] Unit T004 replacement hoses are not supplied by the manufacture of Plasser.

observed hydraulic oil leaking from a hose attached to the boom. The action was aborted, and the crane was lowered and secured into the cradle.

Work activities were canceled, and the boom remained unused. Investigations by the M&M Welding and Fabricator contractor discovered the leaking hose on-site. They determined that the leak only occurred when operating the crane, not when the unit was moving or in use. The onboard spill kit was utilized to clean the residual hydraulic fluid from the area.

Repairs were initiated the next morning. An internal project team discussion occurred the same morning of August 9 where no further elevation was warranted due to the limited quantity of the leak, the fact that the spill was contained within the vehicle, and no environmental impact was observed.

The probable cause of the Hydraulic Fluid Leak event was the failure of a rubber seal on the brake actuator located inside the winch drum of the crane. The boom arm attached to the winch drum is inspected on a six-month basis and a part of that inspection the boom arm is cycled. This failed rubber seal is not inspected during Preventative Maintenance Inspections (PMI) and does not have a history of failing.

Incident Site

First Event (E23550)

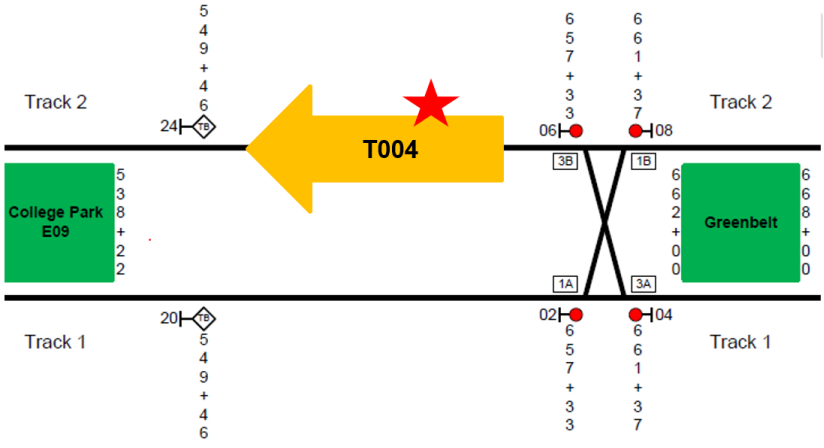
Chain Marker (CM) E2 636+00, Track 2 - outside on the roadway north of a water embankment run off.

Second Event (E23551)

Medical Center Station, Track 1 – underground station.

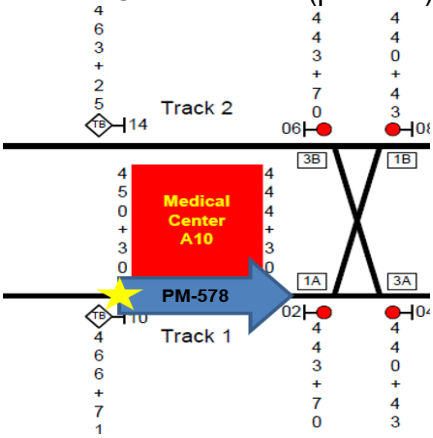
Field Sketch/Schematics

First Event (E23550)
Chain Marker (CM) E2 636+00, Track 2



The above depiction is not to scale.

Second Event (E23551)
Medical Center Station (platform), track 1.



The above depiction is not to scale.

Purpose and Scope

The purpose of this accident investigation and candid self-evaluation is to collect and analyze available facts, determine the probable cause(s) of the incident, identify contributing factors, and make recommendations to prevent a recurrence.

Investigative Methods

The investigative methodologies included the following:

- Site Assessment through video and document review

- Formal Interviews – SAFE interviewed two (2) individuals as part of this investigation. Interview included persons present at, during, and after the incident, those directly involved in the response process, and representatives from the Washington Metrorail Safety Commission (WMSC). SAFE interviewed the following individual:
    - Equipment Operator (PM-578 (E23551))
    - Equipment Operator (T004 (E23550))

- Informal Interviews – Collected through conversations with individuals during the investigation to provide background and supporting information. Written statements were reviewed from personnel present during the event.

- Documentation Review – Collection of relevant work history information and process documentation contained in WMATA systems of record. These records include:
    - Maintenance Operations Control (MOC) Spill Report and Log
    - Daily Check List
    - Metrorail Operating Rulebook (MOR)
    - National Oceanic and Atmospheric Administration (NOAA)
    - Maximo Data

- System Data Recording Review – Collection of information contained in Metro Data Recording Systems. This data includes:
    - ARS (Audio Recording System) playback [MAC/Phone]
    - Closed-Circuit Television (CCTV)

Investigation

First Event (E23550)

On August 9, 2023, at 00:44 hours, the MC notified MOC of a hydraulic leak from Metro 4X4 Tamping Machine Unit T004 at CM E2 636+00, Track 2. It was estimated that 200 Gallons of hydraulic fluid leaked onto the ballast.

According to the MOC Spill Report and Log at 00:45 hours, the Mobile Operations Command notified MOC that 200 gallons of hydraulic fluid leaked from Tamping Unit T004 at CM E2 636+00 in the Green Line shutdown area.

According to the work order at 00:45 hours, the Equipment Operator notified CMNT of the broken hydraulic fluid line.

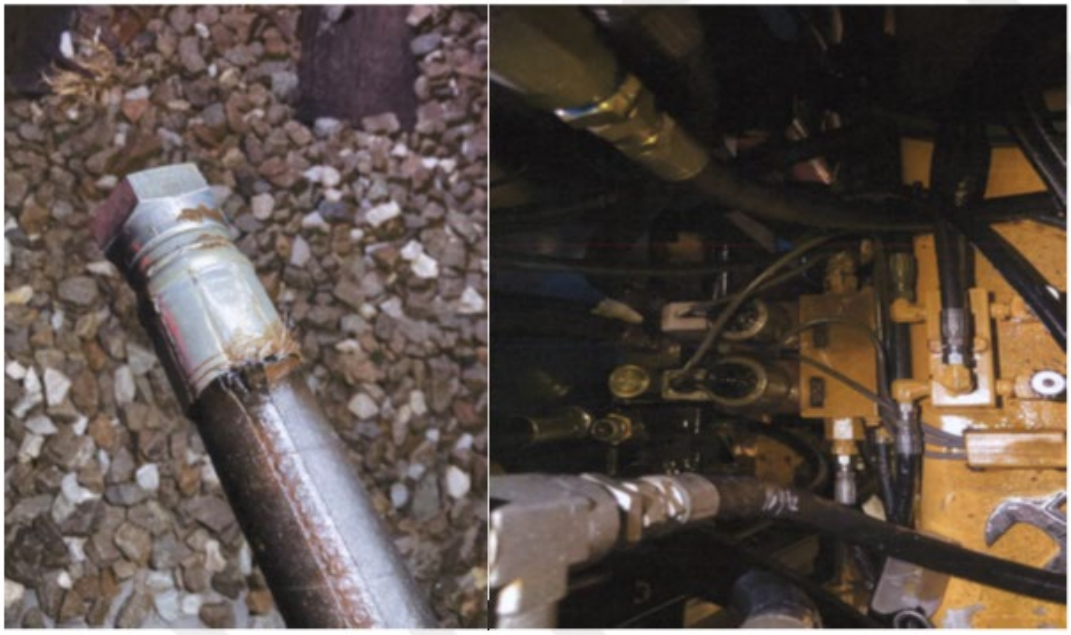


Figure 1 – Tamping Unit T004 broken hydraulic fluid line and the repaired hydraulic fluid line.

Email reports reflect that the pressure line on the left side vibrator failed. Due to the heat coming from the hose line, personnel were unable to cap the line. Spill Booms and absorbent pads were deployed to contain and clean up the hydraulic fluid. The fluid leaked into the ballasted area and down an embankment towards a concrete channel. The fluid did not enter the concrete channel.

Figure 2 - Tamping Unit T004 leaking hydraulic fluid onto Absorbent pads.

Tamping Unit T004 hydraulic fluid line was repaired on the scene, the hydraulic tank was re-filled with 166 gallons, and the unit was returned to Greenbelt Rail Yard.

Figure 3 - depicts absorbent pads leading down the embankment from Tamping Unit T004 containing the hydraulic fluid.

No related radio transmissions were able to be captured in the review of the ARS playback.

It was discovered during a formal interview it was discovered that the material in the on-board spill kit was not enough for the initial spill and responding personnel reported difficulty in securing necessary quantities of spill containment materials. Tamper Unit T004 is inspected every 120 Days and the latest PMI was May 25, 2023.

Safety and Environmental Implications

There was low environmental impact as the leak was contained within the ballasted area and down an embankment area a few feet from a concrete channel. The leak was cleaned up with the onboard spill kit utilizing spill mats and containment booms. TRST removed the contaminated ballast and placed new ballast down. The Office of Environmental Management and Compliance (EMAC) notified the Maryland Department of the Environment's hotline of the spill details at 07:20 hours on August 9, 2023, as required.

Second Event (E23551)

On August 9, 2023, SAFE was notified of a hydraulic leak from Prime Mover PM-578 at Medical Center Station while headed to Shady Grove Rail Yard. It was estimated that 10 to 20 gallons of hydraulic fluid leaked onto track 1.

CCTV A10-P-019 camera showed at 02:05:30 hours, PM-578 arrived on the platform of Medical Center Station (A10) track 1 behind work unit JR03. At 02:10 hours, A10-P-022 camera revealed TRST personnel discovering hydraulic fluid leaking from the boom of PM-578.

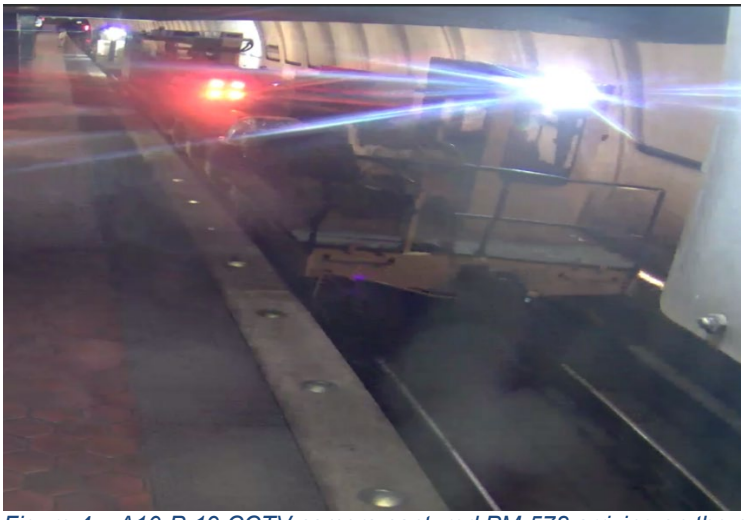


Figure 4 – A10-P-19 CCTV camera captured PM-578 arriving on the platform of Medical Center Station (A10) track 1.

Figure 5 – A10-P-022 CCTV camera captured TRST personnel discovering hydraulic fluid leaking from the boom of PM-578.

According to the MOC Spill Report and Log at 02:10 hours, Prime Mover PM-578 experienced a hydraulic fluid leak at Medical Center Station (A10) on track 1.

PM-578 was loaded onto the roadway via forklift, and the nightly pre-trip inspection was performed before exiting the yard with the M&M Welding and Fabricator Contractor Equipment Operator , TRST Pilot, and TRST flagmen. The PM-578 traveled inbound on track 1 and stopped at Medical Center Station (A10) platform. At the platform, the crane boom needed to be reversed and swung around above the flatcar for later offloading of material. When the unloaded boom was actuated upward, a leaking hydraulic hose was discovered by witnessing leaking oil. The action was aborted, and the crane lowered and resecured into the cradle. An Equipment Mechanic was dispatched to Medical Center Station to assist with the leak and aide in the clean up.

Figure 6 – depicts the winch drum inside the boom near the hydraulic brake.

Figure 7 – depicts a vehicle similar to PM-578 and the boom from which the hydraulic fluid leaked (see arrow).

Work activities were canceled, and the boom remained unused. Investigations by the M&M contractor discovered the leaking hose on-site. They determined that the leak only occurred when

operating the crane, not when the unit was moving or in use. The onboard spill kit was utilized to clean the residual hydraulic fluid from the area.

Repairs were initiated by M&M and WMATA project contact with M&M Project Manager the next morning. An internal project team discussion occurred the same morning where no further elevation was taken due to the quantity of the leak, the fact that the oil was contained within the vehicle, and no environmental impact was observed.

Contract FIRPG211167 was awarded to M&M Welding and Fabricators for the replacement of 7 Drainage Pumping Stations in the Metrorail tunnels. This work's scope included providing one rental work train identified as PM-578. PM-578 has been in service with WMATA for over five years.

No radio transmissions related to this event were found in the review of the ARS playback.

Safety and Environmental Implications

There was no environmental impact as the leak was contained within the vehicle. The leak was cleaned up with the onboard spill kit utilizing absorbent pads and rags.

Chronological Event Timeline

First Event (E23550)

A review of ARS playback, i.e., phone and radio communications, revealed the following timeline:

Time	Description
00:44:58 hours	Mobile Command: Notified MOC that 200 Gallons of Hydraulic Fluid leaked from Tamping Unit T004 at CM E1 635+00. The fluid did not enter the nearby drain. [MOC/Phone]
00:45 hours	Equipment Operator notified CMNT of the blown hydraulic line. [Work Order]
01:55:33 hours	CTEM: Notified MOC that 200 Gallons of Hydraulic Fluid leaked from Tamping Unit T004 onto the ballast and down an embankment; did not enter a drain. [MOC TRST/Phone]
01:58:00 hours	CTEM: Reported to the MAC that 200 Gallons of Hydraulic Fluid leaked from Tamping Unit T004 onto the ballast and down an embankment; did not enter a drain. [MAC/Phone]
02:04:45 hours	MAC: The Safety Director On-Call was notified of the Hazmat Spill. [MAC/Phone]
02:32:13 hours	MAC: WMSC was notified of the Hazmat Spill. WMSC: Issued an event scene release. [MAC/Phone]
02:50:40 hours	MAC: The Safety Investigator On-Call was notified of the Hazmat Spill [MAC/Phone]

***Note: Times above may vary from other systems' timelines based on clock settings and reporting sources*

Second Event (E23551)

A review of ARS playback, i.e., phone and radio communications, revealed the following timeline:

Time	Description
02:13:58 hours	TRST RWIC: Reported to the Radio RTC that Prime Mover 578 was leaking fluid and that a mechanic would have to respond to the Medical Center Station. [Phone]

Time	Description
02:27:19 hours	Radio RTC: Reported the broken hydraulic fluid to the MOC. [Phone]
02:35:27 hours	TRST Pilot: Reported 20 Gallons of Hydraulic Fluid leaked from Prime Mover 578 onto the Prime Mover deck; did not enter a drain. [MAC/Phone]
02:43:39 hours	MAC: The Safety Director On-Call was notified of the Hazmat Spill. [MAC/Phone]
02:46:00 hours	MAC: An attempt was made to notify WMSC of the Hazmat Spill, without success. [MAC/Phone]
02:50:40 hours	MAC: The Safety Investigator On-Call was notified of the Hazmat Spill [MAC/Phone]
02:59:34 hours	MAC: WMSC was notified of the Hazmat Spill and released the scene at 03:00:00 hours. [MAC/Phone]

***Note: Times above may vary from other systems' timelines based on clock settings and reporting sources.*

Digital Images and Photographs

First Event (E23550)

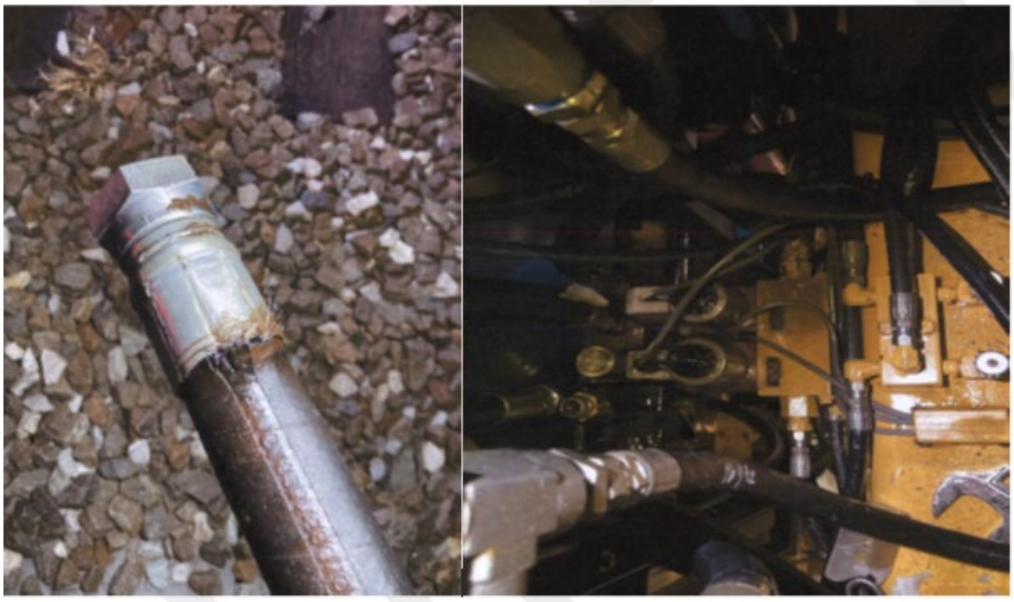


Figure 8 - Tamping Unit T004 broken hydraulic fluid line and the repaired hydraulic fluid line.

Figure 9 - Tamping Unit T004 leaking hydraulic fluid onto Absorbent pads.

Figure 10 - depicts absorbent pads leading down the embankment from Tamping Unit T004 containing the hydraulic fluid.

Physical Evidence

Second Event (E23551)

Figure 11 – Inspection of the winch brake on the boom of PM-578.

Figure 12 - Disassembled winch brake from PM-578.

Figure 13 - Broken seal from winch brake from PM-578.

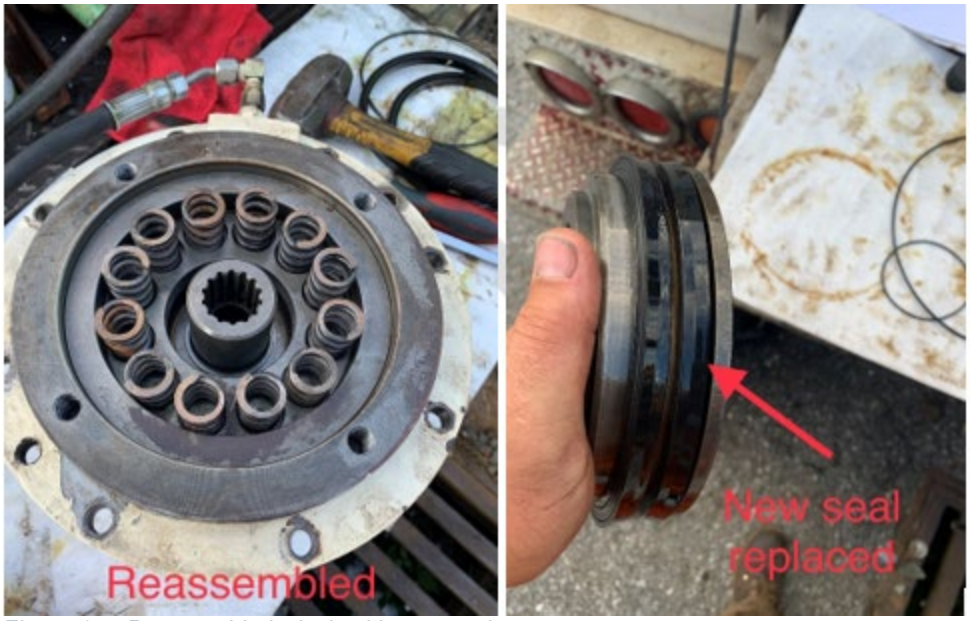


Figure 14 - Reassembled winch with new seal.

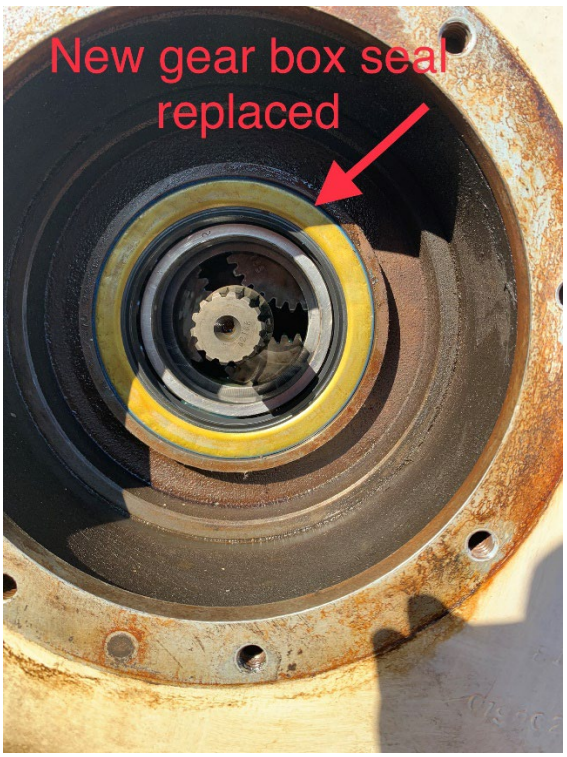


Figure 15 - New winch gear box with replaced seal.

Interview Findings

As part of the investigation launched into the event, SAFE interviewed two people. The interviews identified the following key findings associated with this event. Findings detailed below include reported information from involved personnel and may conflict with other data sources contained in the report.

First Event (E23550)

Equipment Operator Formal Interview

- The Equipment Operator stated a pre-trip inspection was conducted on T004 at the beginning of their shift.
- The Equipment Operator stated they during the pre-trip inspection they visually check for leaking fluids and loose hoses.
- The Equipment Operator stated that it was day light when they conducted their pre-trip inspection.
- The Equipment Operator stated they were working with T004 for two hours prior to the hydraulic fluid leak.
- The Equipment Operator stated a spill kit containing snake barriers and absorbent pads were used to clean up the fluid.

Second Event (E23551)

Equipment Operator Formal Interview

- The Equipment Operator stated they are a contract employee of Crane Rental Incorporated.
- The Equipment Operator stated they were moving PM-578 from Glenmont Station to the work location at Medical Center.
- The Equipment Operator stated they noticed fluid spraying from the winch brake when they arrived at Medical Center Station.
- The Equipment Operator stated the fluid leaked straight down onto the turntable of the crane and the deck of the prime mover.
- The Equipment Operator stated the Prime Mover was shut down when the leak was noticed, and the leak immediately stopped.
- The Equipment Operator stated the onboard spill kit was used to clean up the fluid leak.
- The Equipment Operator stated an internal seal failed and was something that could not have been inspected.
- The Equipment Operator stated fluid leaked onto the concrete of the track and was cleaned up by the Equipment Mechanic dispatched from Shady Grove Yard.
- The Equipment Operator stated a couple of gallons leaked from the Prime Mover.

Weather

First Event (E23550)

On August 9, 2023, at the time of the incident, NOAA recorded the temperature as 70° F, with clear skies. The weather did not contribute to this incident (Weather source: NOAA) – Location: Greenbelt, Maryland.

Second Event (E23551)

On August 9, 2023, at the time of the incident, NOAA recorded the temperature as 72° F, with clear skies. The weather did not contribute to this incident (Weather source: NOAA) – Location: Bethesda, Maryland.

Related Rules and Procedures

Human Factors

Fatigue

First Event (E23550) – Tamping Unit T004 Operator

The biomathematical fatigue modeling application (SAFTE-FAST Web SFC) was not applied for this event because the Tamping Unit Operator was not a contributing factor to the failure of the hydraulic hose.

Second Event (E23551) – Prime Mover 578 Operator

The biomathematical fatigue modeling application (SAFTE-FAST Web SFC) was not applied for this event because the Prime Mover Operator was not a contributing factor to the failure of the hydraulic hose.

Post-Incident Toxicology Testing

First Event (E23550) – Tamping Unit T004 Operator

The Post-Incident Toxicology Testing was not applied for this event because the Tamping Unit Operator was not a contributing factor to the failure of the hydraulic hose.

Second Event (E23551) – Prime Mover 578 Operator

The Post-Incident Toxicology Testing was not applied for this event because the Prime Mover Operator was not a contributing factor to the failure of the hydraulic hose.

Findings

First Event (E23550)

- The leak originated from a hydraulic line rupture.
- The leak was estimated to be 200 gallons of hydraulic fluid.
- Due to the quantity of the leak and proximity to a waterway, additional absorbent pads and booms were brought from Greenbelt Yard.
- Responding personnel reported difficulty in securing necessary quantities of spill containment materials.
- Tamper Unit T004 is inspected every 120 Days.
- The latest PMI was May 25, 2023.

Second Event (E23551)

- The leak originated from within the boom of the crane and only appeared once the crane was put into use.
- The leak was estimated to be approximately 20 gallons and was contained to the deck of the vehicle.
  The last Preventive Maintenance performed on the unit was on June 7, 2023. This included a standard oil change and vehicle inspection.

Immediate Mitigation to Prevent Recurrence

First Event (E23550)

- Tamping Unit T004 was turned off and repaired.
- Hydraulic Line was replaced.
- CMNT, Supply Chain, Warehouse and Logistics (SCWL) and SAFE collaborated to improve the availability of large spill response kits for significant leak/spill events.

Second Event (E23551)

- The work was aborted, and the crane boom hydraulic line was isolated.
- CMNT, Supply Chain, Warehouse and Logistics (SCWL) and SAFE collaborated to improve the availability of large spill response kits for significant leak/spill events.

Probable Cause Statement

First Event (E23550)

The probable cause was a broken hydraulic line. This is due to inadequate installation of the aftermarket hose where there was not enough slack in the hose. The industry standard recommendation for straight hose installation is to allow enough slack (+2% to -4%) in the hose line to provide for changes in length that will occur when pressure is applied. No precursors were noted during the pre-trip inspection.

Second Event (E23551)

The probable cause of the Hydraulic Fluid Leak event was the failure of a rubber seal on the brake actuator located inside the winch drum of the crane. The boom arm attached to the winch drum is inspected on a six-month basis and a part of that inspection the boom arm is cycled.

Recommended Corrective Actions

First Event (E23550)

Corrective Action Code	Description	Responsible Party	Estimated Completion Date
110864_SAFECAPS_CENV_001	Office of Rail Vehicle Program Services – Car Engineering Vehicles will ensure the hydraulic hose is rerouted on all Tamper Units with the industry standard slack of +2% to -4% during the PMI.	Car Engineering Vehicles, Safety Risk Coordinator	09/02/2024
110864_SAFECAPS_CENV_002	Generate an inspection campaign of all Tamper Units for failures (e.g., weeping at the fittings).	Car Engineering Vehicles, Safety Risk Coordinator	Completed
110864_SAFECAPS_CENV_003	Office of Rail Vehicle Program Services - Car Engineering Vehicles will meet monthly to ensure hydraulic hose failures are not trending.	Car Engineering Vehicles, Safety Risk Coordinator	Completed

Second Event (E23551)

There are no recommended corrective actions due to the failure of the rubber seal on the brake actuator being located inside the winch drum of the crane. This is inspected every six months and the boom is cycled as part of the inspection. SAFE recommends continuing with the six-month inspection as this event has not occurred frequently.

Appendices

Appendix A – Interview Summaries

The below narratives summarize the incident and represent the statements made by the involved individual. As such, times and details may present a conflict with the data contained in systems of record.

First Event (E23550)

The Equipment Operator is a WMATA employee.

According to the Equipment Operator, they were operating Tamping Unit T004 for approximately two hours before the fluid leak occurred. While working they noticed a spray of fluid and the tools became stuck in the ground. They were informed by the groundman that the unit was leaking a large amount of fluid. The unit was turned off. The fluid leak was contained and cleaned up using the spill kit containing snake barriers and absorbent pads.

The Equipment Operator conducted a pre-trip inspection of Tamping Unit T004 at the work location due to the unit being stored there. The pre-trip inspection was conducted during day hours in an open area or track.

Second Event (E23551)

The Equipment Operator is a contract employee of Crane Rental Incorporated.

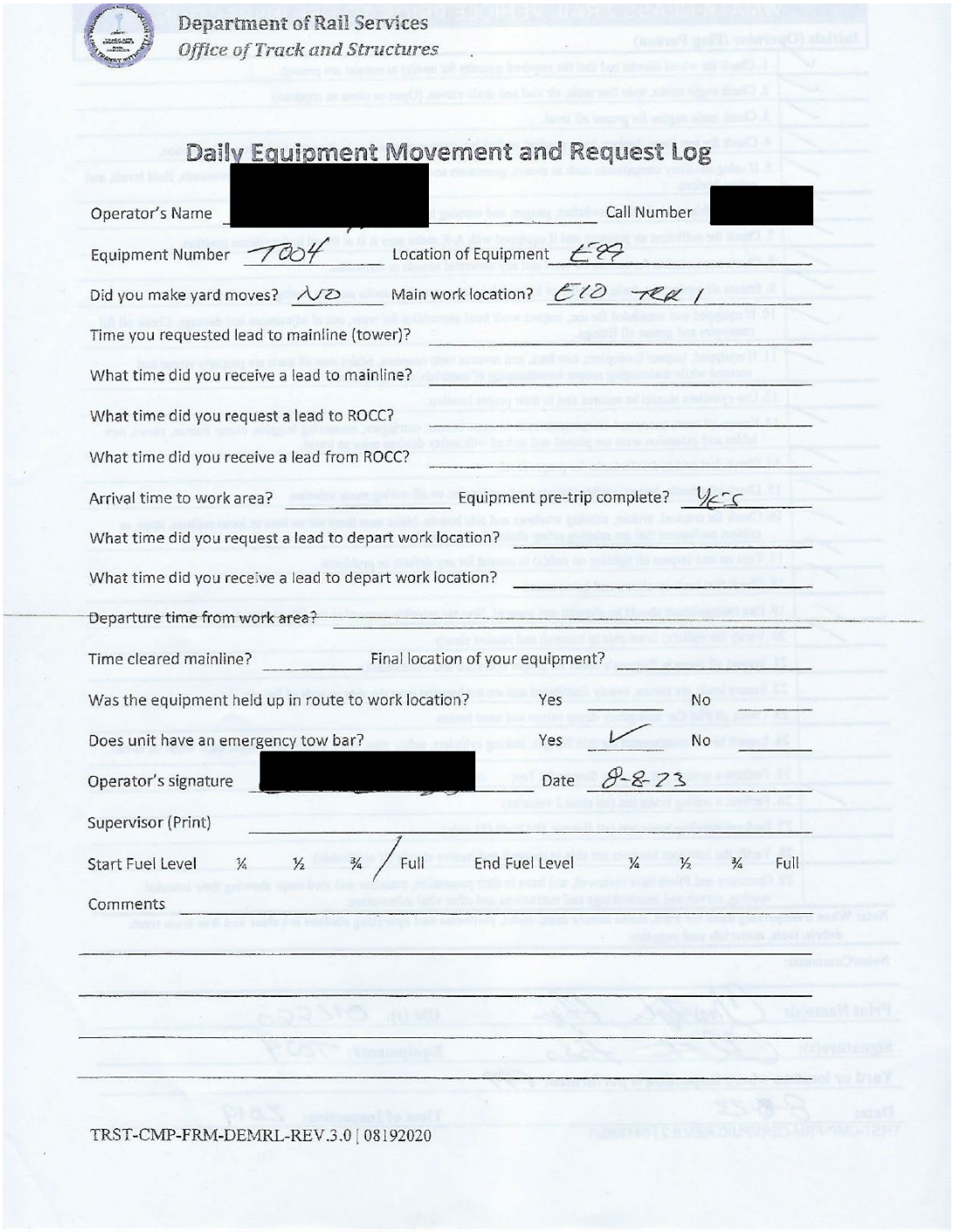
According to the Equipment Operator, they were operating Prime Mover 578 from Glenmont Station to the work location at Medical Center Station. When they arrived at Medical Center Station, the unloaded boom was actuated upward, personnel noticed fluid leaking from the winch brake of the crane. The brake fluid leaked onto the turntable of the crane and deck of the Prime Mover.

The Equipment Operator shut down the Prime Mover. An Equipment Mechanic was requested, and the Spill Kit located on the Prime Mover was used to clean up the fluid. The Equipment Mechanic responded to Medical Center Station and identified the source of the leak.

The Prime Mover was transported to Shady Grove Rail Yard.

Appendix B – Daily Check List

First Event (E23550)



Department of Rail Services
Office of Track and Structures

Daily Equipment Movement and Request Log

Operator's Name [redacted] Call Number [redacted]

Equipment Number T004 Location of Equipment E88

Did you make yard moves? NO Main work location? E10 TRK 1

Time you requested lead to mainline (tower)? _____

What time did you receive a lead to mainline? _____

What time did you request a lead to ROCC? _____

What time did you receive a lead from ROCC? _____

Arrival time to work area? _____ Equipment pre-trip complete? YES

What time did you request a lead to depart work location? _____

What time did you receive a lead to depart work location? _____

Departure time from work area? _____

Time cleared mainline? _____ Final location of your equipment? _____

Was the equipment held up in route to work location? Yes _____ No _____

Does unit have an emergency tow bar? Yes ✓ No _____

Operator's signature [redacted] Date 8-8-23

Supervisor (Print) _____

Start Fuel Level ¼ ½ ¾ / Full End Fuel Level ¼ ½ ¾ Full

Comments _____

TRST-CMP-FRM-DEMRL-REV.3.0 | 08192020

Figure 16 - Dailly Equipment Check List for T004 page 1 of 2.

WMATA CLASS 2 RAIL VEHICLE PRIOR TO USE INSPECTION

Initials (Operator /Flag Person)	
✓	1. Check for wheel chocks and that the required quantity for unit(s) in consist are present.
✓	2. Check angle cocks, train line seals, air tool and drain valves. (Open or close as required).
✓	3. Check main engine for proper oil level.
✓	4. Check for any loose, broken, torn, cracked, or leaking components as you make your walk around inspection.
✓	5. If using auxiliary components such as cranes, generators and compressors, check all controls, movements, fluid levels, and safety devices.
✓	6. Start machine and check all switches, gauges, and warning indicators.
✓	7. Check for sufficient air pressure and if equipped with A-9, make sure it is at 90 psi in the release position.
✓	8. Check transmission for correct oil level and any abnormal sounds or functions.
✓	9. Ensure all equipment, tools, supplies or loose debris are secured on decks and not posing any safety hazards.
✓	10. If equipped and scheduled for use, inspect work head assemblies for wear, out of adjustment and damage. Check oil fill reservoirs and grease all fittings.
✓	11. If equipped, inspect E-couplers, tow bars, and revenue train couplers. Make sure all tools are properly stored and secured while maintaining proper housekeeping of materials and equipment.
✓	12. Gas cylinders should be secured and in their proper location.
✓	13. Ensure all work heads and components such as crane booms, outriggers, measuring buggies, clamp frames, plows, turn tables and extension arms are pinned and locked with safety devices prior to travel.
✓	14. Check fuel and hydraulic tanks for proper level.
✓	15. Check all wheels, brakes, visible linkage, and suspension on all rolling stock vehicles.
✓	16. Check for cracked, broken, missing windows and side boards. Make sure there are no bent or loose railings, steps, or cabinet enclosures that are missing safety chains, locks or latches.
✓	17. Turn on and inspect all lighting on unit(s) in consist for any defects or problems.
✓	18. Check that back up alarms and horns sound.
✓	19. Fire extinguishers should be charged and secured. Sign the monthly inspection log (if not already signed).
✓	20. Verify the radio(s) is/are able to transmit and receive clearly.
	21. Inspect all items in flagman's booth for proper operation and functionality.
	22. Ensure loads are secure, evenly distributed and are not hanging over the side or ends of flat car.
	23. Check all Flat Car emergency dump valves and hand brakes.
	24. Inspect hi-rail components for thin flanges, leaking cylinders, safety pins, tires, shunts, and proper tuck when on hi-rail.
	25. Perform a stretch test. ☐ Successful Test ☐ N/A
✓	26. Perform a rolling brake test (all class 2 vehicles).
	27. Perform standing brake test (all flatcars, PM26-PM53 only).
	28. Verify the intercom headsets are able to transmit and receive clearly (if applicable).
	29. Operators and Pilots have reviewed, and have in their possession, mainline and yard maps showing their intended routing, curves and interlockings and restrictions and other vital information.

Note: When transporting units for PMI, make ensure cabs, decks, platforms and operating stations are clear and free from trash, debris, tools, materials and supplies.

Notes/Comments:

Print Name(s): [redacted] **ID# (s):** [redacted]

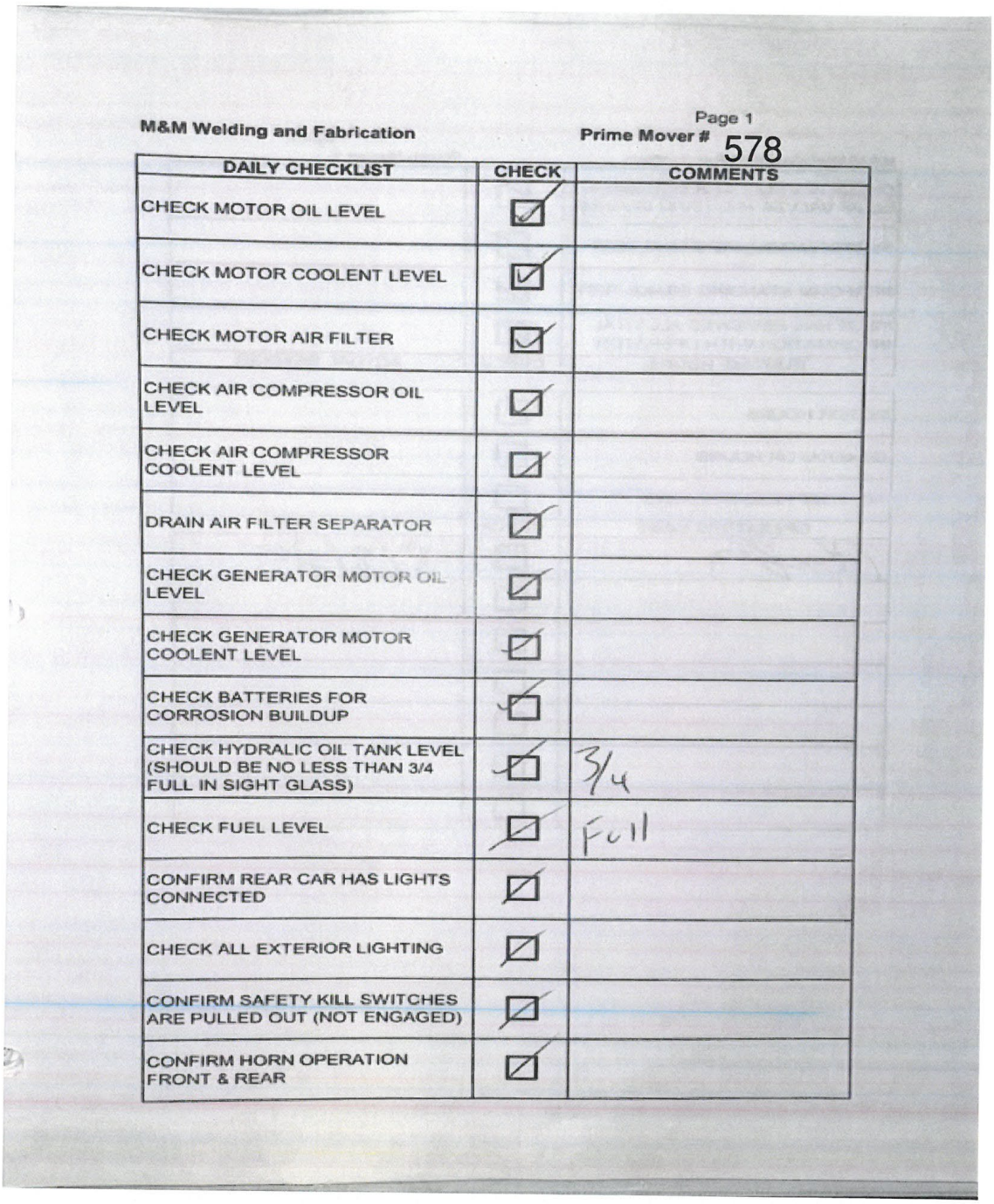
Signature(s): [redacted] **Equipment#:** T004

Yard or location where inspection is performed: E99

Date: 8-8-23 **Time of Inspection:** 2019

TRST-CMP-FRM-C2RVPUIC-REV.5.2 | 04122021

Figure 17 - Dailly Equipment Check List for T004 page 2 of 2.

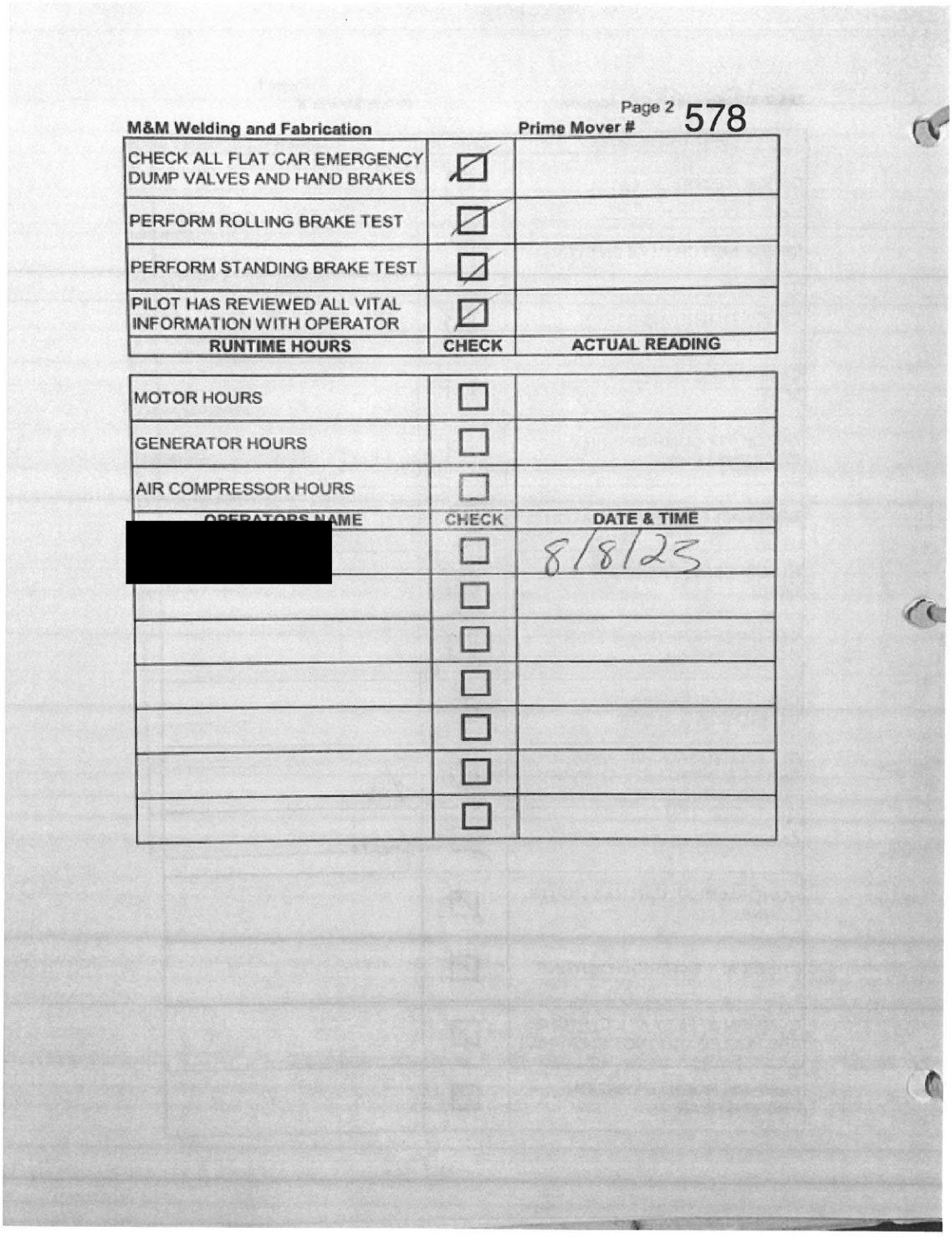


Page 1

M&M Welding and Fabrication **Prime Mover # 578**

DAILY CHECKLIST	CHECK	COMMENTS
CHECK MOTOR OIL LEVEL	☑	
CHECK MOTOR COOLENT LEVEL	☑	
CHECK MOTOR AIR FILTER	☑	
CHECK AIR COMPRESSOR OIL LEVEL	☑	
CHECK AIR COMPRESSOR COOLENT LEVEL	☑	
DRAIN AIR FILTER SEPARATOR	☑	
CHECK GENERATOR MOTOR OIL LEVEL	☑	
CHECK GENERATOR MOTOR COOLENT LEVEL	☑	
CHECK BATTERIES FOR CORROSION BUILDUP	☑	
CHECK HYDRALIC OIL TANK LEVEL (SHOULD BE NO LESS THAN 3/4 FULL IN SIGHT GLASS)	☑	3/4
CHECK FUEL LEVEL	☑	Full
CONFIRM REAR CAR HAS LIGHTS CONNECTED	☑	
CHECK ALL EXTERIOR LIGHTING	☑	
CONFIRM SAFETY KILL SWITCHES ARE PULLED OUT (NOT ENGAGED)	☑	
CONFIRM HORN OPERATION FRONT & REAR	☑	

Figure 18 - Daily Equipment Check List for Prime Mover 578 page 1 of 2.



Page 2

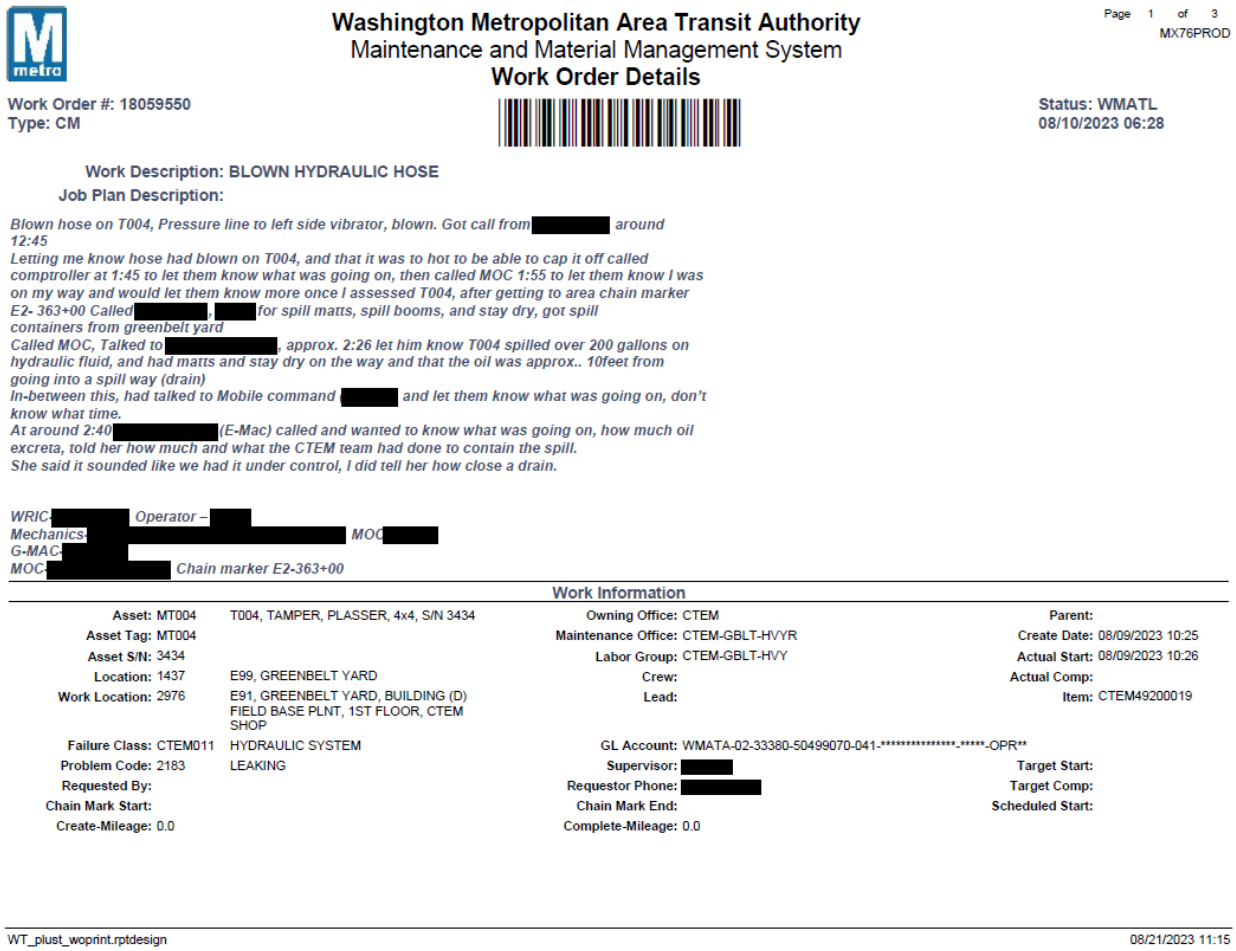
M&M Welding and Fabrication — Prime Mover # 578

CHECK ALL FLAT CAR EMERGENCY DUMP VALVES AND HAND BRAKES	☑	
PERFORM ROLLING BRAKE TEST	☑	
PERFORM STANDING BRAKE TEST	☑	
PILOT HAS REVIEWED ALL VITAL INFORMATION WITH OPERATOR	☑	
RUNTIME HOURS	**CHECK**	**ACTUAL READING**
MOTOR HOURS	☐	
GENERATOR HOURS	☐	
AIR COMPRESSOR HOURS	☐	
OPERATORS NAME	**CHECK**	**DATE & TIME**
[redacted]	☐	8/8/23
	☐	
	☐	
	☐	
	☐	
	☐	
	☐	

Figure 19 - Daily Equipment Check List for Prime Mover 578 page 2 of 2.

Appendix C – Work Orders

Frist Event (E23550)



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

Page 1 of 3
MX76PROD

Work Order #: 18059550
Type: CM

Status: WMATL
08/10/2023 06:28

Work Description: BLOWN HYDRAULIC HOSE
Job Plan Description:

Blown hose on T004, Pressure line to left side vibrator, blown. Got call from [redacted] around 12:45
Letting me know hose had blown on T004, and that it was to hot to be able to cap it off called comptroller at 1:45 to let them know what was going on, then called MOC 1:55 to let them know I was on my way and would let them know more once I assessed T004, after getting to area chain marker E2- 363+00 Called [redacted], [redacted] for spill matts, spill booms, and stay dry, got spill containers from greenbelt yard
Called MOC, Talked to [redacted], approx. 2:26 let him know T004 spilled over 200 gallons on hydraulic fluid, and had matts and stay dry on the way and that the oil was approx.. 10feet from going into a spill way (drain)
In-between this, had talked to Mobile command [redacted] and let them know what was going on, don't know what time.
At around 2:40 [redacted] (E-Mac) called and wanted to know what was going on, how much oil excreta, told her how much and what the CTEM team had done to contain the spill.
She said it sounded like we had it under control, I did tell her how close a drain.

WRIC- [redacted] Operator – [redacted]
Mechanics- [redacted] MOC [redacted]
G-MAC- [redacted]
MOC- [redacted] Chain marker E2-363+00

Work Information

Asset:	MT004	T004, TAMPER, PLASSER, 4x4, S/N 3434	Owning Office:	CTEM	Parent:
Asset Tag:	MT004		Maintenance Office:	CTEM-GBLT-HVYR	Create Date: 08/09/2023 10:25
Asset S/N:	3434		Labor Group:	CTEM-GBLT-HVY	Actual Start: 08/09/2023 10:26
Location:	1437	E99, GREENBELT YARD	Crew:		Actual Comp:
Work Location:	2976	E91, GREENBELT YARD, BUILDING (D) FIELD BASE PLNT, 1ST FLOOR, CTEM SHOP	Lead:		Item: CTEM49200019
Failure Class:	CTEM011	HYDRAULIC SYSTEM	GL Account:	WMATA-02-33380-50499070-041-**********-*****-OPR**	
Problem Code:	2183	LEAKING	Supervisor:	[redacted]	Target Start:
Requested By:			Requestor Phone:	[redacted]	Target Comp:
Chain Mark Start:			Chain Mark End:		Scheduled Start:
Create-Mileage:	0.0		Complete-Mileage:	0.0	

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Figure 20 - Work Order depicting blown hydraulic hose and repairs for T004 page 1 of 3.

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

Work Order #: 18059550
Type: CM

Status: WMATL
08/10/2023 06:28

Work Description: BLOWN HYDRAULIC HOSE
Job Plan Description:

Task IDs

Task ID	
10	Replaced blown hydraulic hose

Replaced blown #20 work hose located on the rear side of the hydraulic tank.
Added 165 gallons of hydraulic oil.
Work was performed on the work site. Hose was removed and made at the shop then installed on the unit.
Unit and track bed was cleaned and repairs were verified.

Component: 000-400-HYD-050 HYDRAULIC, HOSE / LINE **Work Accomp:** INSPECTED **Reason:** INSPECTION **Status:** WMATL **Position:** **Warranty?:** N

Planned Materials

Task ID	Item	Description	Storeroom	Issue Unit	Quantity	Unit Cost	Line Cost
	R47300059	FITTING, HYDRAULIC: CONNECTION A: JIC-FEMALE, CONNECTION B: HOSE CRIMP, HOSE SIZE: 20, HOSE TYPE: PARKER 77 SERIES, MATERIAL: STEEL, SHAPE: STRAIGHT, SIZE A: 20, SIZE B: 20	251	EA	6	$38.54	$231.24
	R91500163	OIL,INDUSTRIAL:INDUSTRIAL: 46, HYDRAULIC, 55 GAL. DRUM	251	EA	2	$658.56	$1,317.12
						Total Planned Materials:	$1,548.36

Actual Labor

Task ID	Labor		Start Date	End Date	Start Time	End Time	Approved?	Regular Hours	Premium Hours	Line Cost
10	E059422	[redacted]	08/09/2023	08/09/2023	06:00	14:00	N	08:00	00:00	$337.13
10	E015406	[redacted]	08/09/2023	08/09/2023	06:00	14:00	N	08:00	00:00	$390.09
							Total Actual Hour/Labor:	16:00	00:00	$727.23

Actual Materials

Task ID	Item	Assetnum	Description	Storeroom	Trans Date	Issue Unit	Quantity	Unit Cost	Line Cost
	R47300059		FITTING, HYDRAULIC: CONNECTION A: JIC-FEMALE, CONNECTION B: HOSE CRIMP, HOSE SIZE: 20, HOSE TYPE: PARKER 77 SERIES, MATERIAL: STEEL, SHAPE: STRAIGHT, SIZE A: 20, SIZE B: 20	251	08/16/2023	EA	6	$52.34	$314.01
			3/8-16x3 socket head bolt		08/09/2023		1	$29.00	$29.00
			5/8-18x2 hex bolts		08/09/2023		1	$29.50	$29.50
								Total Actual Materials:	$372.51

Related Incidents

Ticket	Description	Class	Status	Relationship
8687754	E10 UNIT T004 MOBILE COMMAND REPORTS HYDRAULIC FLUID SPILL 200 GALLONS	SR	RESOLVED	RELATED

Failure Reporting

Cause		Remedy		Supervisor	Remark Date
2671	PHYSICAL DAMAGE	0004	REPLACED	[redacted]	08/21/2023

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Figure 21- Work Order depicting blown hydraulic hose and repairs for T004 page 2 of 3.

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

Work Order #: 18059550
Type: CM

Status: WMATL
08/10/2023 06:28

Work Description: BLOWN HYDRAULIC HOSE
Job Plan Description:

Failure Reporting

Cause	Remedy	Supervisor	Remark Date
Remarks: Replaced #20 hydraulic hose, added oil, cleaned off unit and track bed. Verified Repairs			

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Figure 22 - Work Order depicting blown hydraulic hose and repairs for T004 page 3 of 3.

Appendix D – Industry Hose Routing and Installation recommendation.

Frist Event (E23550)

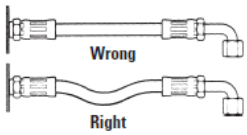
Hose selection

Hose routing and installation

Hose routing and installation

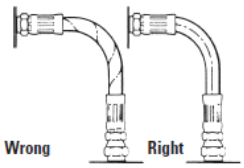
1. Provide for length change.

In straight hose installations, allow enough slack in the hose line to provide for changes in length that will occur when pressure is applied. This change in length can be from +2% to -4%.



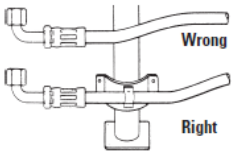
2. Avoid twisting and orient properly.

Do not twist hose during installation. This can be determined by the printed layline on the hose. Pressure applied to a twisted hose can cause hose failure or loosening of connections.



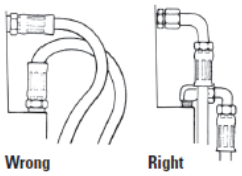
3. Protect from hazardous environment.

Keep hose away from hot parts. High ambient temperature will shorten hose life. If you can not route it away from the heat source, insulate it.



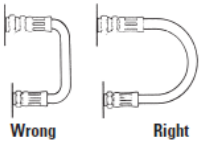
4. Avoid mechanical strain.

Use elbows and adapters in the installation to relieve strain on the assembly and to provide easier and neater installations that are accessible for inspection and maintenance.



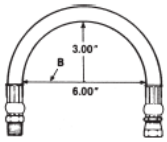
5. Use proper bend radius.

Keep the bend radius of the hose as large as possible to avoid collapsing of the hose and restriction of flow. Follow catalog specs on minimum bend radii.



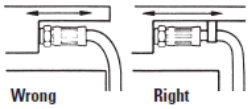
6. Use proper bend radius (cont'd).

Minimum bend radius is measured on the inside bend of the hose. To determine minimum bend, reference the most recent Eaton Catalog page for that hose and use the bend radius listed there.



7. Secure for protection.

Install hose runs to avoid rubbing or abrasion. Use Areoquip Hose Clamps to support long runs of hose or to keep hose away from moving parts. It is important that the clamps not allow the hose to move. This movement will cause abrasion and premature hose failure.



8. Avoid improper hose movement.

Make sure relative motion of the machine components produces bending rather than twisting of the hose. Hose should be routed so that the flex is in the same plane as the equipment movement.

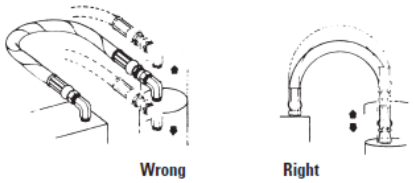


Figure 23 - Industry Hose Routing and Installation recommendation.

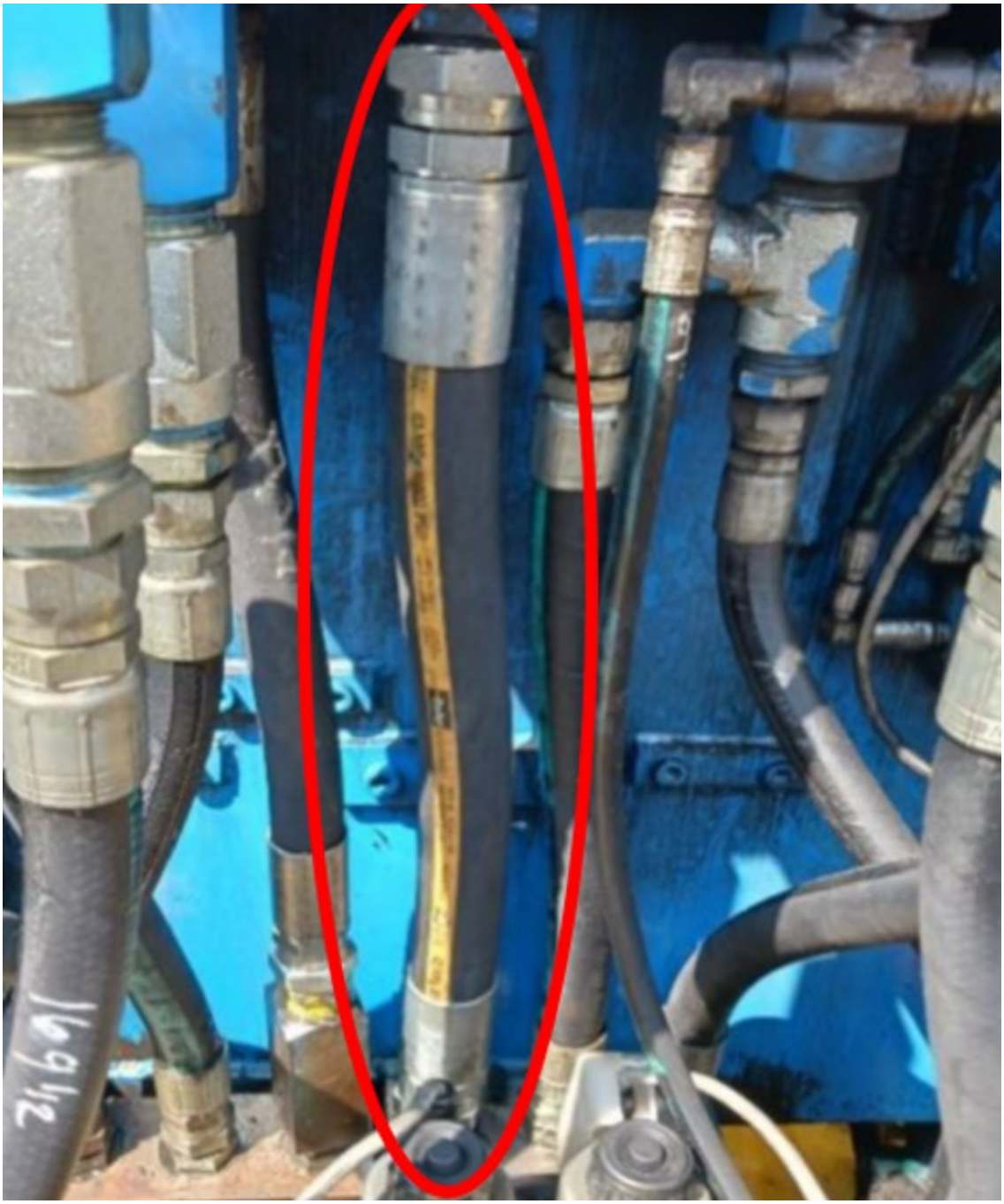


Figure 24 – Depicting the improper straight hose length on a similar tamping unit.