WHENEVER. WHEREVER.
We'll be there.

NEWFOUNDLAND POWER
A FORTIS COMPANY

DELIVERED BY HAND

January 17, 2019

Board of Commissioners of Public Utilities
P.O. Box 21040
120 Torbay Road
St. John's, NL A1A 5B2

Attention: G. Cheryl Blundon
Director of Corporate Services
and Board Secretary

Ladies & Gentlemen:

Re: Use of the Allowance for Unforeseen Items
Water Damage Mobile Diesel Generator

By letter dated October 1, 2018, Newfoundland Power notified the Board that its mobile diesel generator (the "MD3") had sustained serious water damage, rendering the unit inoperable. As noted in the letter, the work to undertake the necessary repairs was initiated forthwith under authority of the Allowance for Unforeseen Items approved by the Board in the 2018 Capital Budget Order.

The MD3 was returned to service during the week of December 17, 2018. The revised Capital Budget Application Guidelines issued by the Board in October 2007 (the "Guidelines") require that the utility notify the Board in writing as soon as is practical regarding use of the Allowance for Unforeseen Items. The Guidelines also provide that, within 30 days after completion of the work, the utility is required to file a report on the matter. The enclosed report entitled *Allowance for Unforeseen Items, Mobile Diesel Generator Water Damage* (the "Report") is submitted in accordance with this reporting requirement.

As noted in the Report, the actual costs incurred in repairing the MD3 totalled $260,000, which is approximately 46% less than the estimate provided in our letter dated October 1, 2018. The lower cost is a result of less internal damage than anticipated and more extensive use of refurbished parts than initially anticipated.

We trust that this completes the reporting requirements in relation to this matter. If you have any questions or require anything further, please contact the undersigned at the direct telephone number noted below.

Newfoundland Power Inc.
55 Kenmount Road • P.O. Box 8910 • St. John's, NL A1B 3P6
PHONE (709) 737-5609 • FAX (709) 737-2974 • **ghayes@newfoundlandpower.com**

Yours very truly,

Gerard M. Hayes
Senior Counsel

c. Geoffrey Young
Newfoundland and Labrador Hydro

Newfoundland Power Inc.
55 Kenmount Road • P.O. Box 8910 • St. John's, NL A1B 3P6
PHONE (709) 737-5609 • FAX (709) 737-2974 • **ghayes@newfoundlandpower.com**

Allowance for Unforeseen Items

Mobile Diesel Generator Water Damage

January 17, 2019

Prepared by:

Brad Tooktoshina, P. Eng.

Jack Casey, P. Eng.

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NEWFOUNDLAND POWER
A FORTIS COMPANY

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A. BACKGROUND

Introduction

Newfoundland Power's (the "Company") Mobile Diesel Generator ("MD3") was commissioned in 2004. The MD3 is rated at 2,500 kW and consists of a 20-cylinder diesel engine, an AC generator, unit controls, switchgear, and a power transformer, all housed on a single mobile trailer. The MD3 is normally stationed at the Grand Bay Substation in Port aux Basques.

Prior to discovery of the water damage, the MD3 had been last operated at Trepassey on April 27, 2018 to support transmission line maintenance. On May 15, 2018, it was transported to the Company's Electrical Maintenance Centre ("EMC") on Topsail Road. The power transformer was removed from the unit, and transported outside the province for a scheduled refurbishment; the trailer and remaining components were parked.

The reinstallation of the refurbished power transformer was completed on August 16, 2018, and preparations commenced to return the MD3 to service. After several unsuccessful attempts to start the generator, the Company contacted Wajax Power Systems ("Wajax") for assistance.[1] The following day, a Wajax technician examined the MD3 and discovered water on top of the pistons. Upon further examination at the Wajax repair facility, it was determined that a large quantity of water had infiltrated the diesel engine. As a result, the engine had sustained significant water damage, rendering it inoperable.

By letter dated October 1, 2018, the Company notified the Board of Commissioners of Public Utilities ("the Board") that it intended to repair the unit under authority of the 2018 Allowance for Unforeseen Items.

Following completion of repairs, the MD3 was successfully returned to service on December 19, 2018.

Water Damage

On August 29, 2018, the MD3 was delivered to the Wajax repair shop in Mount Pearl.[2] Preliminary boroscope inspections had revealed water damage in all 20 cylinders of the diesel engine. In addition, approximately 6 to 7 gallons of water was removed from the cylinders and exhaust manifolds. As a result of the prolonged exposure to moisture, there was corrosion damage to all 20 cylinder heads, cylinder liners and piston assemblies.

It was apparent that water had entered the engine during the time the unit was stored at the EMC awaiting refurbishment of the power transformer. It was surmised that rainwater had infiltrated the exhaust stack through the exhaust cover or flap, which was discovered to have sustained

[1] Wajax is the local authorized original equipment manufacturer's ("OEM") representative for the MD3's diesel engine.

[2] The MD3 trailer is an overweight load that requires special permitting for transport. Turnaround on permit review and approval is typically two weeks.

damage that had gone undetected.[3] It appeared that the damage had allowed the flap to be lifted by strong winds, enabling rainwater to enter the exhaust stack.

A review of historical weather data showed that a significant rain and wind event had occurred in St. John's on May 29-30, 2018. It is believed that the rainwater entered the engine during that event.[4]

A review of security video for the relevant time was inconclusive. Because the only security camera that had the MD3 in view was at some distance from the unit, and the view was further obscured by rain on the lens, the position of the exhaust flap during the weather event could not be determined.

No other possible source for the water infiltration was identified during the subsequent disassembly and repair of the engine.

B. OPERATIONAL IMPACT

The MD3 is an important component of the Company's generation fleet. It is used to minimize customer interruptions in emergency situations and during planned maintenance on distribution, transmission and substation assets. In order to ensure the MD3 was returned to service in advance of the onset of winter, Newfoundland Power chose to proceed with the repairs under authority of the Allowance for Unforeseen Items. There were no feasible alternatives to proceeding with the repair of the unit. Replacement with a new engine would have been significantly more expensive.

In September 2018, the MD3 had been scheduled to return to Trepassey substation to allow the Company to complete planned transmission line maintenance work. Completion of this work prior to the onset of the winter season was critical to ensure continued delivery of safe and reliable service to customers in the Trepassey area.[5]

On December 19, 2018, following completion of the refurbishment, the MD3 was transported to the Company's Blaketown Substation. Blaketown Substation is the closest substation to St. John's that is equipped for efficient connection of the MD3. It was necessary to connect the MD3 to the electrical system to complete testing of the refurbished unit under full load.

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[3] A photograph of the exhaust flap can be found in Appendix A as Figure 1. The damage was not detected because the flap is located on the roof of the enclosure, and is not visible from the ground.

[4] The weather for May 29-30 yielded wind gusts in excess of 90 km/h and total rainfall of over 80 millimetres. This significant rain and wind event is consistent with the amount of water found in the engine.

[5] To ensure the transmission line maintenance could be completed despite the loss of the MD3, the Company promptly investigated rental options with local suppliers. A suitable portable diesel generator was found, and the work was completed prior to the onset of winter.

C. ENGINE DAMAGE ASSESSMENT

The MD3 consists of a 20-cylinder diesel engine, an AC generator, unit controls, switchgear, and a power transformer, all housed on a single mobile trailer. The diesel engine rotates the AC generator which, at full load, can supply 2,500 kW of electrical energy. Water damage was confined to the diesel engine component of the MD3.

Figure 1 is a schematic illustration of the MD3 diesel engine. Water entered the engine though the exhaust system at the top of the engine, identified as item 4 in Figure 1.

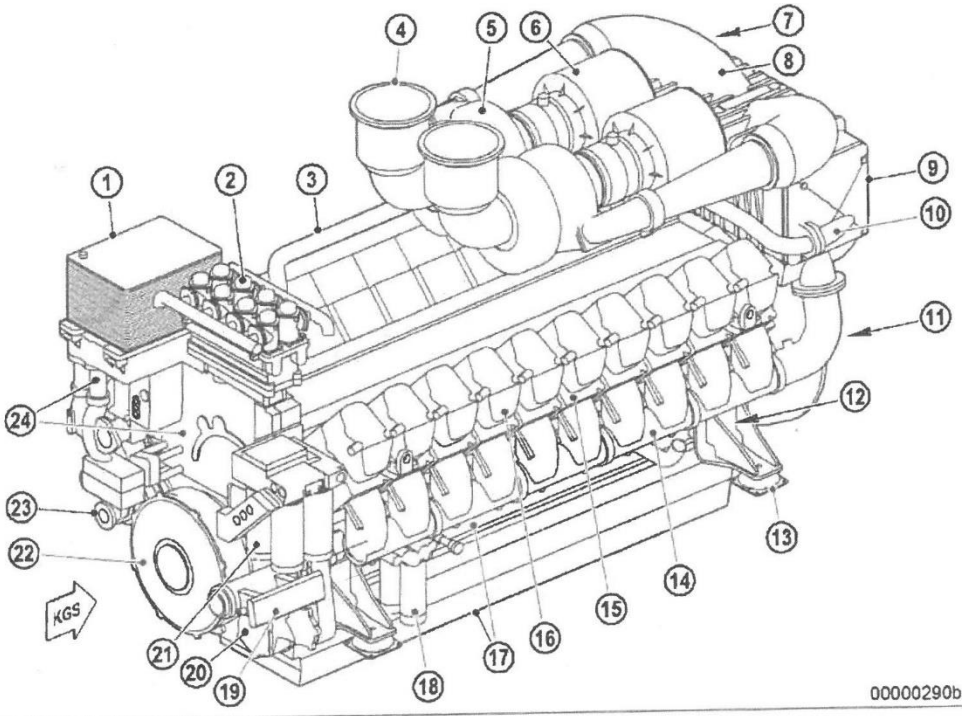

Figure 1 – MD3 Engine Schematic

The water entered the engine through the roof exhaust flap, and filled the exhaust stacks, exhaust turbo chargers and engine exhaust manifolds located at the top of the engine (see Figure 1). From the exhaust manifold, water was able to migrate to the cylinders.

Following its arrival at the Wajax repair facility, the engine was disassembled to facilitate a detailed damage assessment. The disassembly commenced with those parts that were known to have come into contact with water, and continued until the full extent of the damage was established.[6]

Both turbo chargers immediately adjacent to the exhaust system were inspected and found to have sustained water damage.[7] One side was completely seized, while the other could be turned by hand with force. Further disassembly and inspection revealed that both shafts were corroded. However, Wajax technicians determined that both turbo chargers could be salvaged.

All 20 cylinder heads were removed from the engine and found to have significant corrosion damage. Damage was noted on the intake and exhaust valve faces, stems and seats.[8] Because it was determined to be unfeasible to rebuild these onsite, they were replaced with OEM refurbished cylinder head assemblies.[9] Likewise, all 20 cylinder liners were observed to have significant corrosion damage.[10] Wajax determined that all 20 cylinder liners should be pulled out and replaced with new OEM cylinder liners.[11]

All 20 pistons were found to have corrosion on their heads, sides and rings. OEM refurbished piston assemblies were determined to be the least cost option for addressing the corrosion damage. The refurbished piston assemblies included factory restored pistons with new rings and wrist pins.

Multiple connecting rods were found to have slight surface corrosion.[12] All 20 connecting rods were removed, inspected and measured for damage. It was determined that all connecting rods were suitable for reuse. The connecting rods were cleaned and reinstalled. The crank shaft was visually inspected and corrosion was observed on multiple webs.[13] When the connecting rods were removed, it was confirmed that the journal surfaces for the connecting rods were not damaged by water. The crank shaft was determined to be suitable for continued use. To avoid more extensive disassembly, the crank shaft was cleaned in place through the engine inspection covers.

An unusual amount of water was observed dripping from the small condensate drain on the air intake manifold. This indicated that water had infiltrated the air intake side of the engine through the intake valves on some cylinders. Upon inspection, the air intake manifold pipes

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6 Photographs of the damage are shown in Appendix A.

7 A diesel engine turbo charger uses the exhaust stream to compress the combustion air, thereby getting more air mass into the cylinders of the engine and improving engine efficiency.

8 Water damage to the cylinder heads can be seen in Figures 7 and 8 of Appendix A.

9 The OEM, MTU Detroit Diesel, offers factory refurbished parts that meet the specification of new parts at reduced cost on some items that cannot be repaired. There are also further cost reductions available if the existing damaged parts are determined to be in a repairable state by the OEM. If they are able to be factory refurbished, a core refund will also be applied. For example, core credit was received for the cylinder heads and pistons that were returned to the OEM. The refurbished parts were available immediately, saving both time and labour cost.

10 Water damage to the cylinder liners can be seen in Figures 5 and 6 of Appendix A.

11 Refurbished cylinder liners were not available from the OEM.

12 Water damage to the connecting rods can be seen in Figure 4 of Appendix A.

13 Water damage to the crank shaft can be seen in Figure 9 of Appendix A

showed signs of water ingress; however, the water had since drained. A boroscope inspection of the after-cooler confirmed that the volume of water experienced in the intake piping was not enough to reach the after-cooler or compressor side of the turbochargers. All components on the intake side of the engine were found to be undamaged and suitable for continued use.

D. PROJECT SCOPE AND COST

MD3 Refurbishment and Modification

The preliminary boroscope inspections carried out on August 29, 2018, and subsequent inspections completed at the Wajax repair facility in Mount Pearl, revealed significant water damage to all cylinders. Upon disassembly of the engine, it was confirmed that the cylinders, crankshaft and piping, cylinder heads, pistons, intake and exhaust valves and valve seats had all sustained corrosion damage. However, the damage was less extensive than initially anticipated. This resulted in a less costly refurbishment than originally estimated.

The project involved a complete teardown inspection of the engine components, cleaning of all damaged parts that could be refurbished, and replacement of parts that were beyond repair with new or refurbished parts. All required consumables were also provided new.[14] The engine restoration was completed by certified technicians at the Wajax repair facility in Mount Pearl.

To prevent the recurrence of water infiltration through the exhaust system, the exhaust flap was replaced with one of modified design. To ensure the flap will return to the closed position when the unit is offline, mechanical stops were added to restrict the open position to less than 90 degrees. In addition, a mechanical latch was added to ensure the flap remains closed when the unit is not in use.[15] The requirement to manually unlock the latch before starting the unit and lock it when the unit is shut down should eliminate the risk of recurrence.

[14] Consumables include low cost items such as oil filters, seals and gaskets that would be replaced as part of the reassembly of the engine.

[15] The replacement exhaust flap can be seen in Figure 12 of Appendix A

Project Cost

Based on a preliminary examination of the damage, the cost of repairing the MD3 had been estimated at $485,000. Because the damage was not as extensive as initially suspected, and because many parts were able to be cleaned and reused rather than replaced, the final cost of the project was significantly lower. [16]

Table 1 shows the capital expenditures associated with this project.

Table 1
2018 Capital Expenditure

Cost Category	Amount
Material	$233,0000
Labour - Internal	$14,000
Engineering	$12,000
Other	$1,000
Total	**$260,000**

[16] The initial estimate was based on a conservative approach that included a more extensive replacement of damaged parts with new parts. The Company was able to use factory refurbished parts provided by the OEM and obtain core refunds for returned parts. In addition, some major components such as the crank shaft and inter-cooler were undamaged and were returned to service with only cleaning required.

Appendix A
Photographs

Figure 1 - Damaged/Warped Exhaust Flap

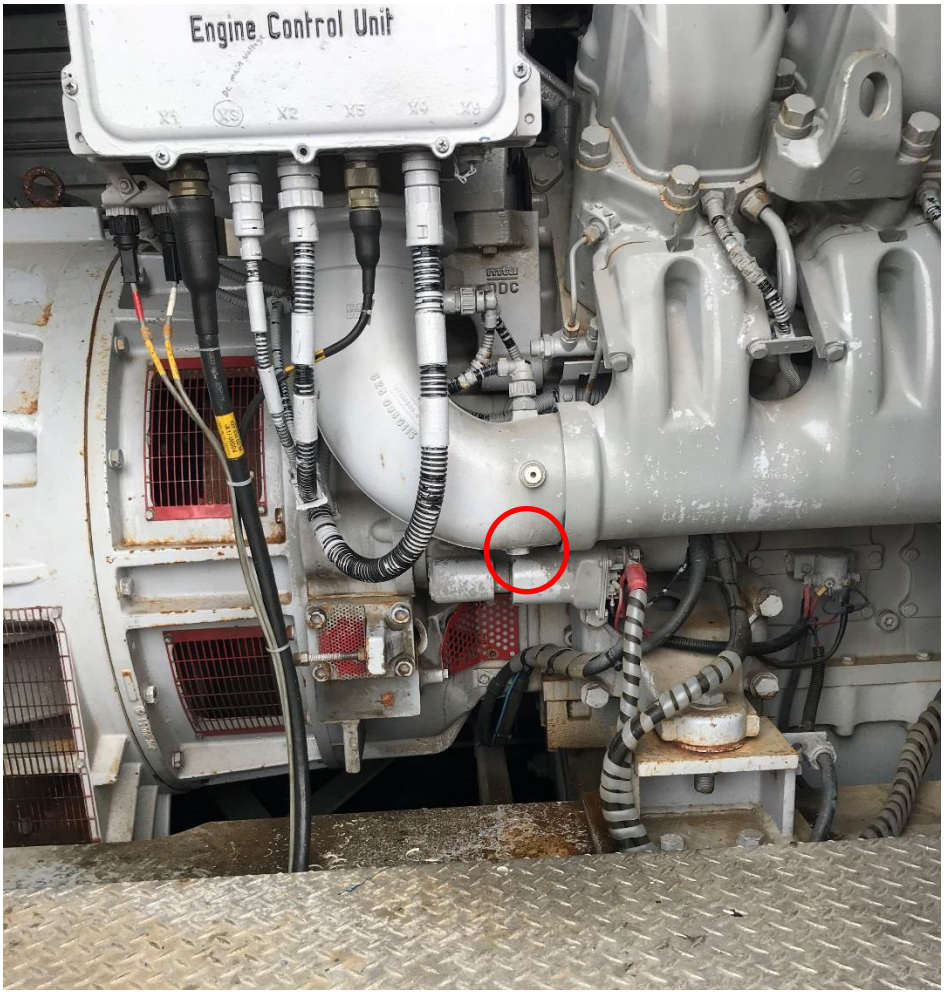

Figure 2 - Intake Manifold. Excess Water was Observed Draining from Condensate Drain.

Figure 3 - Water Observed to Top of Cylinder Head

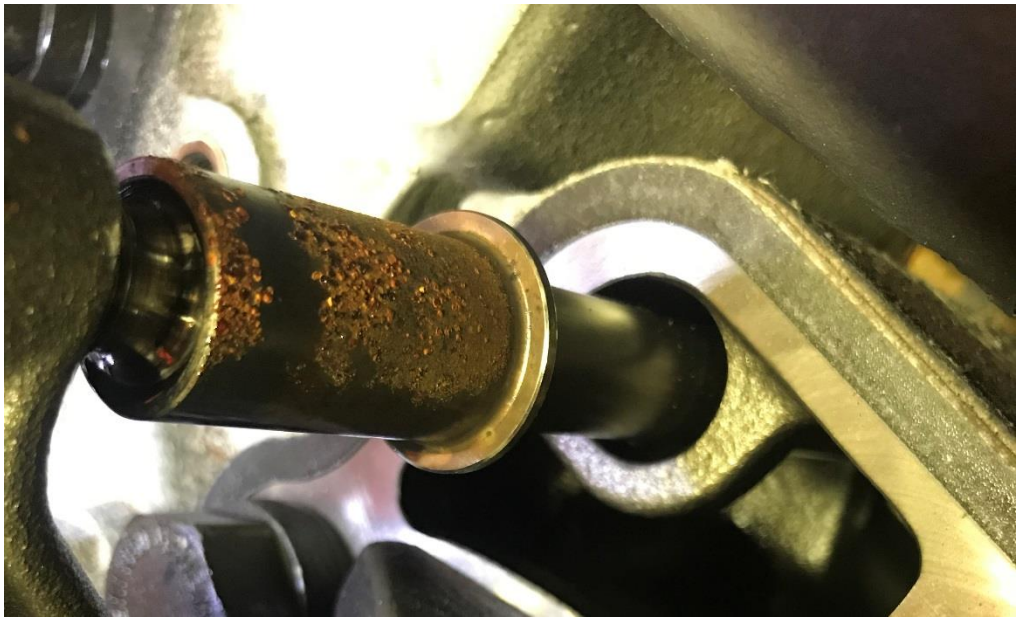

Figure 4 – Surface Corrosion Observed on Push Rod

Figure 5 - Typical Cylinder Liner Condition. Corrosion Also Visible on Pistons

Figure 6 - Cylinder Liner and Piston Condition Observed During Disassembly

Figure 7 - Cylinder Head Condition with Intake and Exhaust Valves Installed

Figure 8 – Typical Cylinder Head Intake and Exhaust Valve Ports. Heavy Corrosion on Valve Seats

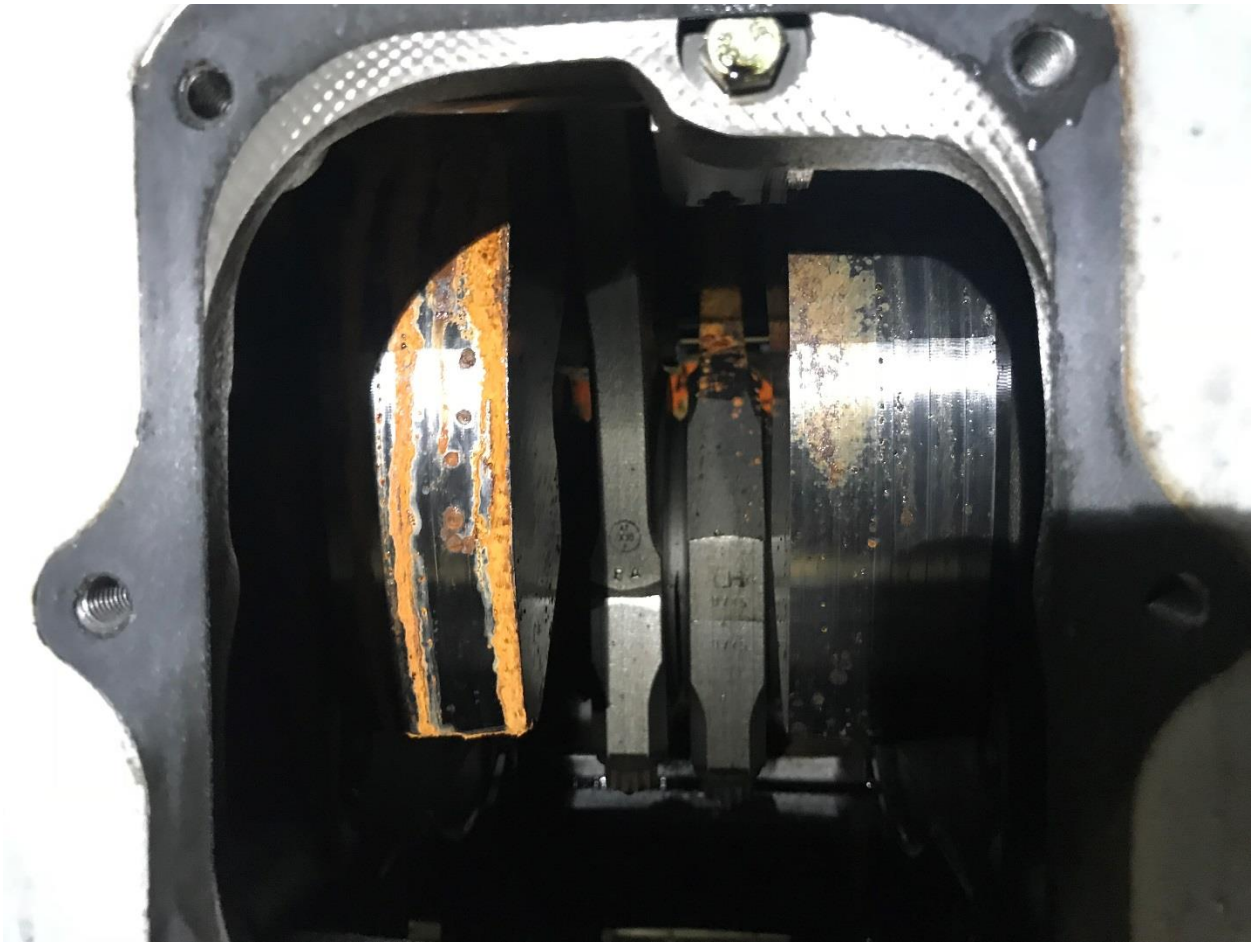

Figure 9 - Typical Surface Corrosion Observed on Crank Shaft.

Figure 10 - New Cylinder Liners and OEM Refurbished Pistons

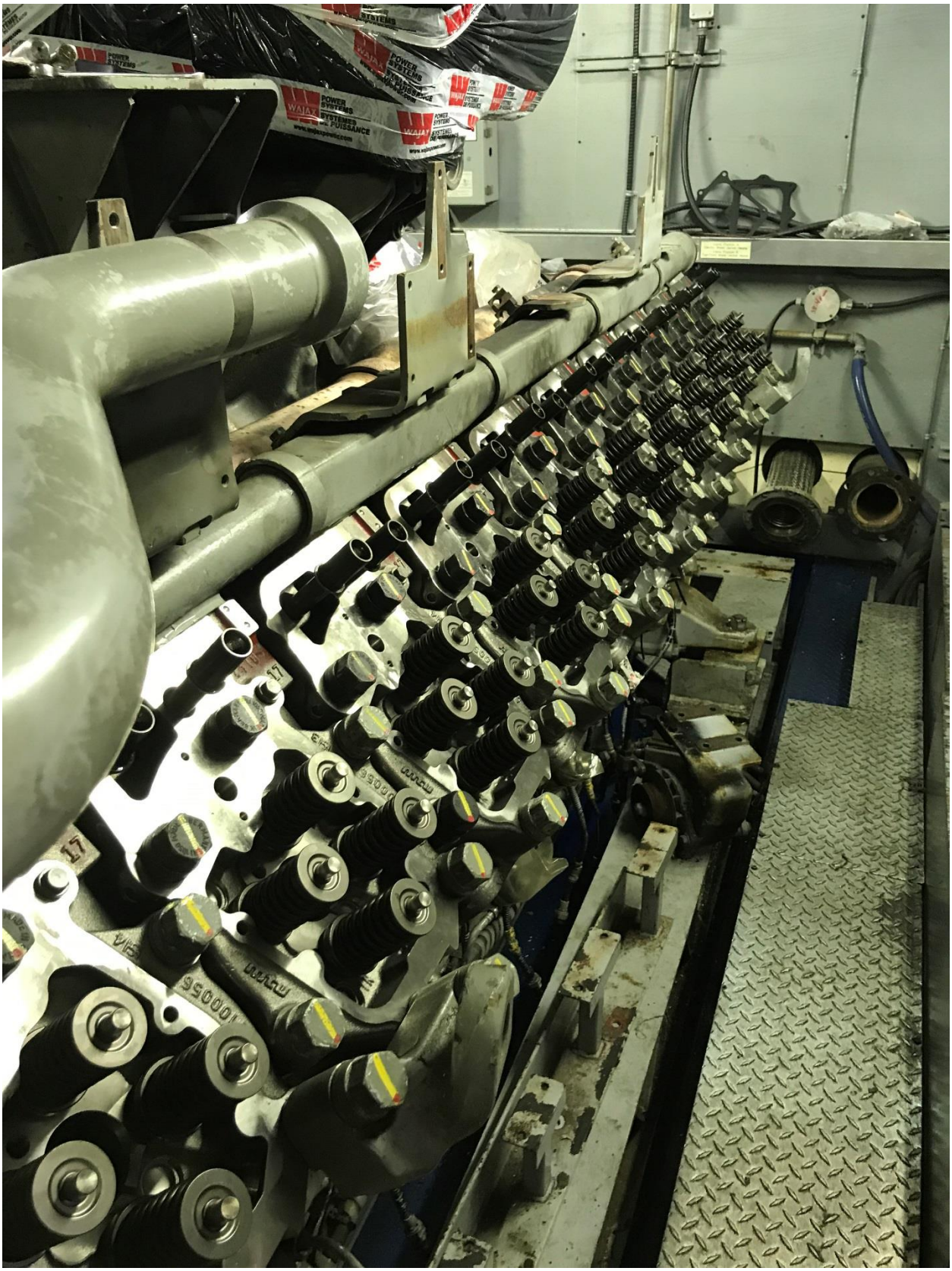

Figure 11 - OEM Refurbished Cylinder Heads Installed

Figure 12 – Exhaust Flap Modified With Securing Latch

Figure 13 - Rented 2 MW Portable Diesel Generator and Mobile Load Bank Setup in Trepassey Substation