

**YEC 2023/24 GRA  
Undertaking  
Responses**

# **Attachment 1**

YEC 2023/24 GRA

Attachment 1 to Undertakings Cover Letter – List of Undertakings and Responses

#	Undertakings	Undertaking Transcript Reference	Undertaking Response
1	UNDERTAKING - TO PROVIDE A RESPONSE TO MR. MAISSAN'S QUESTION REGARDING HIGHER RPM UNITS WERE TYPICALLY CHEAPER TO BUY IN TERMS OF CAPACITY AND HAD A LOWER LIFE THAN LOWER RPM UNITS -- 1,800 RPM AS THE HIGHER SPEED AND THE LOWER BEING EITHER 12 OR 900 RPM -- AND TO ADVISE IF THAT IS STILL TRUE TODAY OR IF THERE IS NEW TECHNOLOGY DEVELOPMENT IN DIESELS THAT MAKES THAT NO LONGER TRUE	March 4, 2024, Volume 1, page 63, lines 10-19	March 4, 2024, Volume 1, page 70, lines 14-23
2	UNDERTAKING - FOR YEC TO CONFIRM THAT THE DIESELS THAT WE SEE HERE (EXHIBIT 12), ARE THESE THE SUM TOTALS OF ALL THE DIESELS THAT ARE RUNNING, OR ARE THERE SOME DIESELS THAT ARE NOT INTEGRATED INTO THESE GRAPHS	March 4, 2024, Volume 1, page 69, lines 4-9	March 4, 2024, Volume 1, page 71, line 4 - page 72, line 10
3	UNDERTAKING - TO PROVIDE A BREAKDOWN OF THE OPERATING AND MAINTENANCE LABOUR COMPONENT THAT'S RELATED TO YUKON ENERGY OWNED THERMAL UNITS	March 4, 2024, Volume 1, page 73, lines 18-21	Please see Attachment 2, Undertaking #3
4	UNDERTAKING - TO ADVISE IF YUKON ENERGY HAS A COST PER KILOWATT HOUR FOR WHITEHORSE FOR THE RENTALS AND FOR THE YEC-OWNED DIESELS AND FOR LNG AND THE TURBINES, THE WATER, THE HYDRO (SEE TEXT)	March 4, 2024, Volume 1, page 93, lines 1-6	March 5, 2024, Volume 2, page 157, line 21 - page 162, line 21
5	UNDERTAKING - TO PROVIDE AN ESTIMATE OF THE PERCENTAGE OF INCREASE YEC SEES IN HEATING THROUGH THE WHOLE SYSTEM	March 4, 2024, Volume 1, page 102, line 24 - page 103, line 1	March 4, 2024, Volume 1, page 111, line 16 - page 112, line 4
6	UNDERTAKING - TO PROVIDE A PERCENTAGE OF WHAT RIDER F WOULD BE OF THE TOTAL BILL. FOR EXAMPLE, THE INCREASE WAS 10 PERCENT, BUT THE RIDER F WAS A DECREASE OF 8 PERCENT, SO WE'RE PAYING 2 PERCENT HIGHER	March 4, 2024, Volume 1, page 118, lines 15-20	March 5, 2024, Volume 2, page 155, line 15 - page 156, line 24
7	UNDERTAKING - FOR TABLE 3.1 TO BE PUT INTO PERCENTILES BESIDE THE DOLLAR COSTS	March 5, 2024, Volume 2, page 167, lines 13-15	Please see Attachment 2, Undertaking #7
8	UNDERTAKING - TO PROVIDE UPDATED BCUC RETURN PERCENTAGE FROM THE 9.65, SPECIFICALLY THE AMOUNT OF DOLLARS AND THE PERCENTAGE OF THE REVENUE REQUIREMENT USING THIS NEW BCUC DECISION AMOUNT, AND TO PROVIDE THE SAME NUMBERS FOR A PLUS 40 BASIS-POINTS-RISK PREMIUM	March 5, 2024, Volume 2, page 171, lines 6-12	March 5, 2024, Volume 2, page 171, line 24 - page 172, line 22
9	UNDERTAKING - TO ADVISE IF THERE IS CLAUSE IN THE CONTRACT WITH ONE OF THE MINES THAT ALLOWS FOR PEAK SHIFTING	March 5, 2024, Volume 2, page 194, lines 7-9	March 6, 2024, Volume 3, page 321, line 24 - page 322, line 24
10	UNDERTAKING - TO PROVIDE A DOLLAR AMOUNT BREAKDOWN OF INTERNAL VERSUS EXTERNAL RESOURCES	March 5, 2024, Volume 2, page 198, lines 16-18	March 6, 2024, Volume 3, page 317, line 8 - page 320, line 2
11	UNDERTAKING - TO PROVIDE PRELIMINARY ENGINEERING COST ESTIMATE AND COST OVERRUNS FOR THE DIESEL REPLACEMENTS	March 5, 2024, Volume 2, page 201, lines 6-8	March 6, 2024, Volume 3, page 320, line 3 - page 321, line 22
12	UNDERTAKING - TO ADVISE WHAT PORTION OF THE \$1.262 MILLION IS FOR CONSULTANTS AND LEGAL FEES (SEE TEXT)	March 5, 2024, Volume 2, page 209, lines 17-19	March 6, 2024, Volume 3, page 322, line 25 - page 325, line 9
13	UNDERTAKING - TO PROVIDE A CLEARER ANSWER REGARDING DSM COSTS AS REFERENCED AT PDF 191, LINE 31 TO 36, THAT SPEAKS TO RATE BASE ADDITIONS DURING THE 2021 GRA (SEE TEXT)	March 5, 2024, Volume 2, page 223, lines 9-13	Please see Attachment 2, Undertaking #13
14	UNDERTAKING - TO CONFIRM WHETHER THE SPECIFICATIONS OF THE UNIT YEC INTENDS TO PUT IN ON THE FARO DIESEL REPLACEMENT PROJECT ARE THE SAME AS THOSE FOUND IN EXHIBIT 4, PAGE 13,	March 5, 2024, Volume 2, page 271, lines 16-20	Revised as Undertaking #15
15	UNDERTAKING - TO CONFIRM WHETHER THE SPECIFICATIONS OF THE UNIT YEC INTENDS TO PUT IN ON THE FARO DIESEL REPLACEMENT PROJECT ARE THE SAME AS THOSE FOUND IN EXHIBIT 4, PAGE 13, AND TO PROVIDE THE DETAILS ON THE FINAL SPECIFICATIONS FOR THE EXHAUST TREATMENT AS WELL CONFIRMING MEETING TIER 4 REQUIREMENTS - REVISED	March 5, 2024, Volume 2, page 274, lines 9-17	Please see Attachment 2, Undertaking #15
16	UNDERTAKING - TO ADVISE IF THERE IS DOCUMENTATION ON HOW DD2 AND DD5 HAVE BEEN UPDATED RECENTLY WHEN THEY WERE DERATED IN 2011 AND THEN RIGHT NOW UPDATED, AND TO CONFIRM WHICH IR THAT THE INFORMATION WAS PROVIDED	March 5, 2024, Volume 2, page 296, lines 5-10	March 7, 2024, Volume 4, page 459, line 14 - page 461, line 1
17	UNDERTAKING - TO ADVISE OF HOW MANY HOURS YEC REGISTERED ON FD7 TO DATE	March 6, 2024, Volume 3, page 308, lines 6-7	March 7, 2024, Volume 4, page 533, lines 12-23
18	UNDERTAKING - TO PROVIDE THE INSPECTION REPORTS FROM COLLICUTT ENERGY, WHO DID THE INSPECTION IN 2021	March 6, 2024, Volume 3, page 308, line 25 - page 309, line 2	Please see Attachment 2, Undertaking #18
19	UNDERTAKING - TO CONFIRM IF THE DEPENDABLE CAPACITY WHICH IS LISTED AS THE SAME AS THE NAMEPLATE CAPACITY IS STILL CONSIDERED VALID 310	March 6, 2024, Volume 3, page 310, lines 10-13	March 7, 2024, Volume 4, page 461, lines 7-15 [please also see Undertaking #42]
20	UNDERTAKING - WITH REFERENCE TO EXHIBIT 4, PAGE 4, REGARDING DD1, TO CONFIRM THE WORK THAT WAS DONE TO INCREASE FROM THE ORIGINAL NAMEPLATE CAPACITY	March 6, 2024, Volume 3, page 311, lines 7-11	Please see revised response in Attachment 2, Undertaking #43
21	UNDERTAKING - TO ADVISE HOW YOU GO ABOUT CHANGING THE NAMEPLATE CAPACITY OF A UNIT	March 6, 2024, Volume 3, page 312, lines 22-24	Please see Attachment 2, Undertaking #21
22	UNDERTAKING - TO UPDATE TABLE 3.4 TO INCLUDE TWO ADDITIONAL COLUMNS FOR ACTUAL 2023 AND YEAR-TO-DATE 2024 TO SHOW THE SEPARATE VACANCIES SPOKEN OF EARLIER AND BASICALLY WHERE YEC IS IN ORDER TO HAVE A CLEAR TABLE 3.4 RATHER THAN JUST PROPOSED 2023 AND PROPOSED 2024	March 6, 2024, Volume 3, page 342, lines 9-16	Please see Attachment 2, Undertaking #22

#	Undertakings	Undertaking Transcript Reference	Undertaking Response
23	UNDERTAKING - TO PROVIDE A POINT-FORM SUMMARY OF ALL CHANGES SPECIFIED BY YEC IN ITS UPDATE AND THE REASONS FOR THE CHANGE. SECONDLY, TO PROVIDE REVISED TABS 2, 3, 5, AND 7 AND ANY GRA SCHEDULES IN THOSE TABS THAT INCORPORATE THE CHANGES SPECIFIED IN THE UPDATE TO SHOW HOW THE CHANGES HAVE AFFECTED YEC'S APPLIED-FOR REVENUE REQUIREMENT	March 6, 2024, Volume 3, page 343, lines 9-18	Response due date is extended to March 19, 2024 [Transcript Volume 4, page 458, lines 8-18]
24	UNDERTAKING - TO EXPLAIN THE REASONS WHY YEC UNDERSPENT IN 2018 ITS COMBINED T&D BRUSHING COSTS WHEN COMPARED TO THE 2018 APPROVED BRUSHING COSTS	March 6, 2024, Volume 3, page 347, lines 2-5	March 7, 2024, Volume 4, page 462, lines 10-18
25	UNDERTAKING - TO PROVIDE YEC'S ACTUAL COMBINED TRANSMISSION AND DISTRIBUTION BRUSHING COSTS FOR THE YEARS 2019 AND 2020	March 6, 2024, Volume 3, page 347, lines 15-18	March 7, 2024, Volume 4, page 462, lines 19-23
26	UNDERTAKING - TO PROVIDE THE PRELIMINARY NON-AUDITED NUMBERS FOR YEC'S BRUSHING COSTS FOR THE ACTUAL COMBINED TRANSMISSION AND DISTRIBUTION BRUSHING COSTS IN 2023	March 6, 2024, Volume 3, page 349, lines 17-21	March 7, 2024, Volume 4, page 462, line 24 - page 463, line 2
27	UNDERTAKING - TO RESUBMIT THE CAPITALIZATION POLICY REGARDING PROPERTY, PLANT, AND EQUIPMENT	March 6, 2024, Volume 3, page 370, lines 19-21	Please see Attachment 2, Undertaking #27
28	UNDERTAKING - TO PROVIDE AN ESTIMATE OR LISTING AND THE YEAR FOR THE STUDY COSTS THAT HAVE BEEN EXPENSED	March 6, 2024, Volume 3, page 384, lines 23-25	Please see Attachment 2, Undertaking #28
29	UNDERTAKING - TO PROVIDE A LIST OF PROJECTS LESS THAN \$100,000 THAT ARE INCLUDED AT TABLE 5.6 IN THE APPLICATION	March 6, 2024, Volume 3, page 386, lines 3-6	Please see Attachment 2, Undertaking #29
30	UNDERTAKING - TO PROVIDE AN EXCEL WORKBOOK SHOWING THE CALCULATION OF EACH OF THE YEARS OF THE AFUDC AMOUNT SHOWN IN EXHIBIT 2, THE RESPONSE TO UCG-31 AT PDF PAGE 197	March 6, 2024, Volume 3, page 438, lines 19-23	Please see Attachment 2, Undertaking #30
31	UNDERTAKING - WITH REFERENCE TO EXHIBIT 2 AT PDF PAGES 193 AND 194, A UCG IR, AND THE TABLE THAT WAS PROVIDED, TO BREAK OUT WHICH YEAR OF COSTS IN THAT TABLE HAVE BEEN ALLOCATED TO EITHER THE 3-YEAR, THE 5-YEAR, OR THE 25-YEAR LICENCE RENEWALS, OR ANY OTHER LICENCE RENEWALS, AND TO PROVIDE SAME	March 6, 2024, Volume 3, page 440, lines 11-19	Please see Attachment 2, Undertaking #31
32	UNDERTAKING - WITH REFERENCE TO EXHIBIT 2 AT PDF PAGES 193 AND 194, A UCG IR, AND THE TABLE THAT WAS PROVIDED, TO ADVISE OF HOW MUCH AFUDC IS INCLUDED FOR EACH YEAR FOR EACH OF THOSE ACTUAL AND FORECAST LICENCE RENEWAL COSTS	March 6, 2024, Volume 3, page 441, lines 14-20	Please see Attachment 2, Undertaking #32
33	UNDERTAKING - WITH REFERENCE TO EXHIBIT 2 AT PDF PAGES 193 AND 194, A UCG IR, AND THE TABLE THAT WAS PROVIDED, TO ADVISE OF THE ACTUAL LICENCE RENEWAL COSTS, WHAT THEY WERE FOR 2023 FOR EACH OF THE 5-YEAR AND 25-YEAR RENEWALS	March 6, 2024, Volume 3, page 442, lines 6-12	Please see Attachment 2, Undertaking #33
34	UNDERTAKING - TO PROVIDE WHAT THOSE AFUDC COSTS WERE AND THE YEARS THAT IT WAS CHARGED	March 7, 2024, Volume 4, page 473, lines 5-7	Please see Attachment 2, Undertaking #34
35	UNDERTAKING - TO ADVISE WHAT AMOUNTS OF AFUDC WAS INCLUDED IN THAT 789,000, AND IN WHICH YEARS	March 7, 2024, Volume 4, page 473, lines 22-24	Please see Attachment 2, Undertaking #35
36	UNDERTAKING - TO PROVIDE WHAT AMOUNTS OF AFUDC WERE INCLUDED IN THE OVER \$10 MILLION AND IN WHICH YEARS WERE THEY CHARGED	March 7, 2024, Volume 4, page 475, line 25 - page 476, line 3	Please see Attachment 2, Undertaking #36
37	UNDERTAKING - TO ADVISE WHETHER THE PPA HAD SECURITY PROVISIONS, AND IF SO, WHETHER THE SECURITY PROVISIONS COVER USAGE AND ELECTRICAL SERVICE COSTS IN ADDITION TO CONSTRUCTION COSTS	March 7, 2024, Volume 4, page 478, lines 13-17	Please see Attachment 2, Undertaking #37
38	UNDERTAKING - TO EXPLAIN HOW THE ACCOUNTING ENTRY FOR THE LOW WATER RESERVE FUND WOULD BE MADE WHEN THERE WAS INTEREST CHARGED TO THE BALANCE IN THE LOW WATER RESERVE FUND	March 7, 2024, Volume 4, page 511, lines 1-5	Please see Attachment 2, Undertaking #38
39	UNDERTAKING - TO PROVIDE AN ANSWER TO THE QUESTION: "NOW, WITH REGARD TO THE TEN-YEAR RESOURCE PLAN, DO YOU HAVE ANY ESTIMATE OF HOW MUCH THAT WILL COST? OH, AND I'M SORRY, IT'S THE ELECTRICITY PLAN, THE TEN-YEAR ELECTRICITY PLAN THAT YOU STATED YOU'RE WORKING ON."	March 7, 2024, Volume 4, page 534, lines 11-17	Please see Attachment 2, Undertaking #39
40	UNDERTAKING - CONFIRM IF THE WHITEHORSE INTERCONNECTION WAS CONSIDERED AND INCLUDED AS PART OF THE BESS PROCEEDING	March 7, 2024, Volume 4, page 538, lines 8-10	March 7, 2024, Volume 4, page 538, line 23 - page 539, line 4
41	UNDERTAKING - TO CONFIRM THAT LINE 355 SERVES THE VILLAGE OF HAINES JUNCTION AND CHECK THE NUMBER OF CUSTOMERS AFFECTED BY THE AUGUST 3RD OUTAGE	March 7, 2024, Volume 4, page 566, lines 9-12	Please see Attachment 2, Undertaking #41
42	UNDERTAKING - TO PROVIDE THE EXTERNAL ASSESSMENT REFERENCED (SEE TEXT)	March 7, 2024, Volume 4, page 574, lines 3-4	Please see Attachment 2, Undertaking #42
43	UNDERTAKING - TO CONFIRM THE DETAILS OF CHANGING THE NAMEPLATE CAPACITY ON DD1	March 7, 2024, Volume 4, page 577, lines 10-11	Please see Attachment 2, Undertaking #43

# **Attachment 2**

## **YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

### **Undertaking #3**

- March 4, 2024 Transcript, page 73, lines 18-21: To provide a breakdown of the Operating and Maintenance Labour component that's related to Yukon Energy owned thermal units.

### **YEC Response:**

This undertaking was partially answered during the Oral Hearing [see March 4, 2024 Transcript page 112, lines 7-17], and the following additional information concerning the 2024 test year is provided in further response to this undertaking:

- The proposed 2024 labour costs of \$6.034 that are specified in Table 3.5 of Exhibit 1 (PDF page 64) include \$0.848 million related to diesel production (for YEC owned units) and \$0.257 million related to LNG production. As noted in YUB-YEC-1-24(e) (Exhibit 2, PDF page 270), YEC does not incur incremental labour costs for operating the rental diesel generating units.
- The proposed 2024 non-labour costs of \$7.343 million for diesel production that are specified in Table 3.5 include \$6.761 million diesel rental cost [net of spares] and a net cost of \$0.582 million related to YEC owned units.
- All of the proposed 2024 non-labour costs of \$0.407 million for LNG production that are specified in Table 3.5 are related to YEC owned units, as YEC does not rent any LNG units.

## YEC 2023/24 GRA

Exhibit # \_\_\_\_\_

### Undertaking #7

- March 5, 2024 Transcript, page 167, lines 13-15: For Table 3.1 to be put into percentiles beside the dollar costs.

### YEC Response:

Please see the table below that includes the percentage changes as requested.

	Approved 2021	Actual 2021	Change 2021 Actual over 2021 Approved	Actual 2022	Change 2022 Actual over 2021 Actual	Proposed 2023	Change 2023 Forecast over 2022 Actual	Proposed 2024	Change 2024 Forecast over 2023 Forecast
Fuel and Purchased Power	\$ 15,882	\$ 12,667	-20%	\$ 15,051	19%	\$ 16,272	8%	\$ 16,967	4%
Non-Fuel Operating and Maintenance	28,575	28,667	0%	30,828	8%	34,999	14%	37,484	7%
Depreciation and Amortization	12,631	13,692	8%	11,094	-19%	11,997	8%	15,161	26%
Return on Rate Base	16,161	16,448	2%	18,503	12%	18,172	-2%	20,814	15%
Revenue Requirement/Revenue	\$ 73,249	\$ 71,473	-2%	\$ 75,475	6%	\$ 81,440	8%	\$ 90,425	11%

## **YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

### **Undertaking #13**

- March 5, 2024 Transcript, page 223, lines 9-13: To provide a clearer answer regarding DSM costs as referenced at [Exhibit 2] pdf 191, line 31 to 36, that speaks to rate base additions during the 2021 GRA.

### **YEC Response:**

In YUB Order 2022-03, Appendix A, paragraph 311, the Board found that YEC's forecast costs in 2021 for Residential Demand Response Pilot (\$0.035 million) and for DSM Program Design of future DSM programs (\$0.085 million) were reasonable. This resulted in total approved DSM costs of \$0.120 million for 2021 expenditures (in addition to approved 2021 GRA DSM costs of \$0.151 million for 2019 and 2020 expenditures, for a combined total of \$0.272 million).

As illustrated in Table 5.2 of Tab 5 of the 2023/24 GRA, actual expenditures for DSM Project Development in 2021 were \$0.246 million, out of which \$0.010 million was closed to rate base in 2021, and the remaining amount was kept in WIP and subsequently closed to rate base in 2022 as illustrated in Table 5.3. Table 5.2 shows total DSM WIP at the end of 2021, net of contributions, of \$0.145 million.

## YEC 2023/24 GRA

Exhibit # \_\_\_\_\_

### Undertaking #15

- March 5, 2024 Transcript, page 274, lines 9-17: To confirm whether the specifications of the unit YEC intends to put in on the Faro Diesel Replacement Project are the same as those found in Exhibit 4, page 13, and to provide the details on the final specifications for the exhaust treatment as well confirming meeting Tier 4 requirements.

### YEC Response:

This response provides further information in addition to the specifications for YEC's 2.5 MW diesel replacement units set out in NY-YEC-1-14 REVISED Attachment 1 (Exhibit 4, pp. 13-16).

Attachment 1 to this undertaking response provides the specifications for the units to be installed for the Faro Diesel Replacement Project, and Attachment 2 to this undertaking response provides details of the SCR emissions control system required for exhaust treatment to conform with Tier 4 requirements.

Although the engines from the manufacturer are certified as Tier 2, YEC is adding an SCR system to the exhaust to meet Tier 4 emission standards based on the following recommendations from Finning:



### 3.2.2 EPA Tier 4 Engine Emissions

Per the Off-road compression-ignition (mobile and stationary) engine emission regulations, Tier 4 emissions are not required for prime or standby stationary engines for backup or remote locations. Remote locations being defined as jurisdictions outside of the North American Electric Reliability Corporation.

Table 3: Applicable tiers for Canadian SCI engine imports, model year 2021 and later

Power Range	Non-Backup and Non-Remote	Backup or Remote
≤37 kW	Tier 4	Tier 2
>37 kW to ≤560 kW	Tier 4	Tier 3
>560 kW	Tier 4	Tier 2

Table #6 Canadian Emission Regulation Table for CI Engines

To meet Tier 4 emission compliance, Finning recommends using an aftermarket SCR solution. High level details of this system are as follows:

EMISSIONS	CATALYST INLET	CATALYST OUTLET
NOx (g/hp-h)	6.07	0.50
CO (g/hp-h)	0.50	0.50
VOC (g/hp-h)	0.04	0.04
PM (g/hp-h)	0.04	0.02

The following table shows the emission output at the Catalyst Outlet that matches the Caterpillar performance data sheet for Tier 4 emissions, and that will be provided by the SCR emissions control system as detailed in Attachment 2.

**Table 2 – Emissions Data at Full Engine Load**

<b>Engine Option</b>	<b>Emissions</b>	<b>Catalyst Inlet</b>	<b>Emissions Requirement</b>	<b>Catalyst Outlet</b>
CAT C175-16	NOx (g/HP-h)	6.07	0.50	0.50
	CO (g/HP-h)	0.50	2.60	< 0.50
	VOC (g/HP-h)	0.04	0.14	< 0.04
	PM (g/HP-h)	0.04	0.02	0.02



# Cat® C175-16

## Diesel Generator Sets

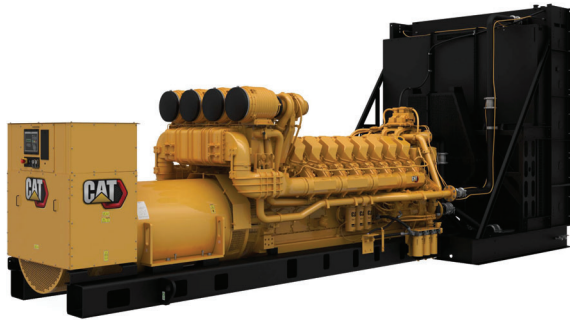


Image shown may not reflect actual configuration

Bore – mm (in)	175 (6.89)
Stroke – mm (in)	220 (8.66)
Displacement – L (in <sup>3</sup> )	84.7 (5166.88)
Compression Ratio	16.7:1
Aspiration	TA
Fuel System	Common Rail
Governor Type	ADEM™ A4

Standby 60 Hz ekW (kVA)	Mission Critical 60 Hz ekW (kVA)	Prime 60 Hz ekW (kVA)	Continuous 60 Hz ekW (kVA)	Emissions Performance
3100 (3875)	3100 (3875)	2825 (3531)	2600 (3250)	U.S. EPA Stationary Emergency Use Only. (Tier 2)

### Features

#### Cat® Diesel Engine

- Meets U.S. EPA Stationary Emergency Use Only (Tier 2) emission standards
- Reliable performance proven in thousands of applications worldwide

#### Generator Set Package

- Accepts 100% block load in one step and meets NFPA 110 loading requirements
- Conforms to ISO 8528-5 G3 load acceptance requirements
- Reliability verified through torsional vibration, fuel consumption, oil consumption, transient performance, and endurance testing

#### Alternators

- Superior motor starting capability minimizes need for oversizing generator
- Designed to match performance and output characteristics of Cat diesel engines

#### EMCP 4 Control Panels

- User-friendly interface and navigation
- Scalable system to meet a wide range of installation requirements
- Expansion modules and site specific programming for specific customer requirements

#### Warranty

- 24 months/1000-hour warranty for standby and mission critical ratings
- 12 months/unlimited hour warranty for prime and continuous ratings
- Extended service protection is available to provide extended coverage options

#### Worldwide Product Support

- Cat dealers have over 1,800 dealer branch stores operating in 200 countries
- Your local Cat dealer provides extensive post-sale support, including maintenance and repair agreements

#### Financing

- Caterpillar offers an array of financial products to help you succeed through financial service excellence
- Options include loans, finance lease, operating lease, working capital, and revolving line of credit
- Contact your local Cat dealer for availability in your region

## C175-16 Diesel Generator Sets Electric Power

### Package Performance

Performance	Standby	Mission Critical	Prime	Continuous
Frequency	60 Hz	60 Hz	60 Hz	60 Hz
Gen set power rating without fan	3100 eKW	3100 eKW	2825 eKW	2600 eKW
Gen set power rating without fan @ 0.8 power factor	3875 kVA	3875 kVA	3531 kVA	3250 kVA
Emissions	EPA ESE (Tier 2)	EPA ESE (Tier 2)	EPA ESE (Tier 2)	EPA ESE (Tier 2)
Performance number	DM8455-12	DM9239-09	DM8706-09	DM8707-07
<b>Fuel Consumption</b>				
100% load without fan – L/hr (gal/hr)	789.6 (208.6)	789.6 (208.6)	692.4 (182.9)	633.4 (167.3)
75% load without fan – L/hr (gal/hr)	589.2 (155.7)	589.2 (155.7)	543.6 (143.6)	500.3 (132.2)
50% load without fan – L/hr (gal/hr)	461.1 (121.8)	461.1 (121.8)	431.6 (114.0)	406.0 (107.3)
25% load without fan – L/hr (gal/hr)	265.0 (70.0)	265.0 (70.0)	255.8 (67.6)	239.1 (63.2)
<b>Cooling System</b>				
Engine coolant capacity – L (gal)	303.5 (80.2)	303.5 (80.2)	303.5 (80.2)	303.5 (80.2)
<b>Inlet Air</b>				
Combustion air inlet flow rate – m <sup>3</sup> /min (cfm)	275.4 (9723.4)	275.4 (9723.4)	247.0 (8722.7)	230.9 (8153.2)
<b>Exhaust System</b>				
Exhaust stack gas temperature – °C (°F)	473.3 (883.9)	473.3 (883.9)	460.0 (860.0)	443.9 (831.0)
Exhaust gas flow rate – m <sup>3</sup> /min (cfm)	708.6 (25020.7)	708.6 (25020.7)	627.6 (22162.0)	572.6 (20217.9)
Exhaust system backpressure (maximum allowable) – kPa (in. water)	6.7 (27.0)	6.7 (27.0)	6.7 (27.0)	6.7 (27.0)
<b>Heat Rejection</b>				
Heat rejection to jacket water – kW (Btu/min)	1409 (80118)	1409 (80118)	1233 (70109)	1146 (65175)
Heat rejection to exhaust (total) – kW (Btu/min)	3195 (181715)	3195 (181715)	2692 (153112)	2464 (140107)
Heat rejection to aftercooler – kW (Btu/min)	538 (30595)	538 (30595)	384 (21817)	343 (19490)
Heat rejection to atmosphere from engine – kW (Btu/min)	156 (8885)	156 (8885)	169 (9592)	164 (9349)
Heat rejection from alternator – kW (Btu/min)	119 (6773)	119 (6773)	109 (6170)	94 (5363)
<b>Emissions* (Nominal)</b>				
NOx mg/Nm <sup>3</sup> (g/hp-h)	2568.0 (5.19)	2568.0 (5.19)	3292.8 (6.32)	3246.1 (6.07)
CO mg/Nm <sup>3</sup> (g/hp-h)	89.2 (0.21)	89.2 (0.21)	191.2 (0.42)	232.3 (0.50)
HC mg/Nm <sup>3</sup> (g/hp-h)	14.0 (0.04)	14.0 (0.04)	16.5 (0.04)	16.1 (0.04)
PM mg/Nm <sup>3</sup> (g/hp-h)	30.8 (0.08)	30.8 (0.08)	15.2 (0.04)	15.5 (0.04)
<b>Emissions* (Potential Site Variation)</b>				
NOx mg/Nm <sup>3</sup> (g/hp-h)	3081.6 (6.23)	3081.6 (6.23)	3951.3 (7.58)	3895.4 (7.29)
CO mg/Nm <sup>3</sup> (g/hp-h)	160.5 (0.38)	160.5 (0.38)	344.2 (0.75)	418.1 (0.90)
HC mg/Nm <sup>3</sup> (g/hp-h)	18.6 (0.05)	18.6 (0.05)	21.9 (0.06)	21.4 (0.06)
PM mg/Nm <sup>3</sup> (g/hp-h)	43.1 (0.12)	43.1 (0.12)	21.3 (0.05)	21.7 (0.05)

\*mg/Nm<sup>3</sup> levels are corrected to 5% O<sub>2</sub>. Contact your local Cat dealer for further information.

# **ecoCUBE® SCR Emission Control System**

**For (2) x CAT C175-16 (2,600kW) Diesel Generator  
Sets**

**DESIGN PARAMETERS**

The design of the emissions reduction system is based on the following conditions. Note: NOx is calculated as NO<sub>2</sub>.

**Table 1 – Engine Data**

<b>Engine Type:</b>	<b>CAT C175-16</b>
<b>Application</b>	Prime
<b>Engine Power</b>	2600 ekW
<b>Exhaust Temperature</b>	444 °C
<b>Design Exhaust Flow Rate</b>	16658 (kg/hr (wet))
<b>Fuel Type</b>	Diesel

**Table 2 – Emissions Data at Full Engine Load**

<b>Engine Option</b>	<b>Emissions</b>	<b>Catalyst Inlet</b>	<b>Emissions Requirement</b>	<b>Catalyst Outlet</b>
CAT C175-16	NOx (g/HP-h)	6.07	0.50	0.50
	CO (g/HP-h)	0.50	2.60	0.50
	VOC (g/HP-h)	0.04	0.14	0.04
	PM (g/HP-h)	0.04	0.020	0.020

Notes: (1) The EPA does not treat methane and ethane as VOC's. achieve a stated reduction of VOC's based on the EPA definition assuming that the VOC's manifest themselves as propene. (2) all emissions reductions are based on an average at steady state using SCAQMD method 100.1 for NOx and SCAQMD/EPA methods 25.1/25.3 for CO and VOC's or mutually agreed test method approved in writing. (3) if NMHC/VOC data isn't provided 0.6 g/hp-hr is to be assumed (unless otherwise stated).

**Table 3 – SCR System Data**

<b>Engine Option</b>	<b>CAT C175-16</b>
<b>Max. Ammonia Slip @ 15% O2</b>	8 ppm
<b>Urea Consumption - 32.5% solution (+/- 15%)</b>	39.3 lph
<b>System Pressure Loss</b>	17.0" WC
<b>System Inlet/Outlet ANSI Flange Inches</b>	28/28

**YEC 2023/24 GRA**

**Exhibit #\_\_\_\_\_**

**Undertaking #18**

- March 6, 2024 Transcript, page 308, line 25 – page 309, line 2: To provide the inspection reports from Collicutt Energy, who did the inspection in 2021.

**YEC Response:**

Please see Attachment 1 for a copy of Collicutt August 23, 2021 monitoring report and Attachment 2 for Inspection Summary.



Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071



**Faro Yukon – Cat 3612 Generator Conditional Monitoring Report**

**Monday Aug 23 – Conditional Monitoring**

**Monitoring Equipment:**

Windrock 6320/PA reciprocating machinery analyzer, ultrasonic survey, and visual inspection for failed or damaged components.

**Provided Operating and Performance Info Provided:**

The Cat 3612 diesel genset is reported to have approximately 28,000 hours. During discussions with the power station operator and maintenance staff, no major vibration, mechanical or reliability issues were indicated. The unit is a 900 rpm 3000 kW rated unit. The unit was loaded to 2950 kW (98%) during the testing. It was reported that this unit does not normally run at 98% load and is usually at ~90%.

**Previous Analysis Date:**

This is the first analysis completed by Collicutt on this equipment.

**Engine Health Assessment** <If yellow or red create finding>

Cylinder	1L	1R	2L	2R	3L	3R	4L	4R	5L	5R	6L	6R
<b>Cylinder Assessment</b>												
Combustion Blowdown	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Valve Dynamics <Impacts, late closures, etc., yellow or red>	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Balance, PFP, Compression Pressure	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Ignition	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green	Green	Green
Borescope Inspection	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
<b>Engine Assessment</b>												
Loading Appropriate	Green											
Bearing knocks	Green											
Oil analysis	Green											
Crankcase Pressure/Blowby	Green											
Oil Level	Green											
Oil Usage Trend	Green											
Exhaust Back Pressure	Green											
Intake Restriction	Green											
Emissions (NO <sub>x</sub> , CO, O <sub>2</sub> )	Green											

<b>Green – Good</b>
<b>Yellow – Possible Improvement</b>
<b>Red – Requires Work</b>



Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

**Operating Conditions, Data and Calculations**

(From unit panel or gauges, can paste in manual report and refer to that page.)

Speed(s) (rpm)	Run #1 – 900
Load (kW)	2950
Other	

Station: Yukon Energy  
 Machine: Faro 3612 Diesel

Date: 08-23-2021  
 Run: 1

Manual Reading Name	Reading	Date	Time
1> Int Manifold Temp	153.00	8-23-21	14:32:13
2> RPM	910.00	8-23-21	14:32:25
3> Cat Panel Load %	95.00	8-23-21	14:32:40
4> Unit Hours	28767.0	8-23-21	14:33:11
5> Manifold Pressure	23.00	8-23-21	14:33:58
6> Main Fuel Pressure	77.00	8-23-21	14:34:12
7> Fuel Pressure	76.50	8-23-21	14:41:02
8> Eng Oil Pressure	68.00	8-23-21	14:34:31
9> Eng Oil Differential Press kPa	1.100	8-23-21	14:34:41
10> Block Temp	190.00	8-23-21	14:38:38
11> Inner Damper Temp	119.00	8-23-21	14:37:50
12> Outer Damper Temp	77.00	8-23-21	14:38:01
13> Oil Filter Diff Press	1.100	8-23-21	14:35:43
14> Exhaust Temp Cylinder #1	947.02	8-23-21	14:29:59
15> Exhaust Temp Cylinder #2	928.02	8-23-21	14:30:08
16> Exhaust Temp Cylinder #3	960.02	8-23-21	14:30:16
17> Exhaust Temp Cylinder #4	954.02	8-23-21	14:30:26
18> Exhaust Temp Cylinder #5	1003.0	8-23-21	14:30:35
19> Exhaust Temp Cylinder #6	962.02	8-23-21	14:30:49
20> Exhaust Temp Cylinder #7	960.02	8-23-21	14:31:07
21> Exhaust Temp Cylinder #8	940.02	8-23-21	14:31:16
22> Exhaust Temp Cylinder #9	992.02	8-23-21	14:31:25
23> Exhaust Temp Cylinder #10	969.02	8-23-21	14:31:31
24> Exhaust Temp Cylinder #11	977.02	8-23-21	14:31:38
25> Exhaust Temp Cylinder #12	985.02	8-23-21	14:31:47



Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

Station: Yukon Energy								
Machine: Faro 3612 Diesel								
Point Description	Channel Number	Current Overall	Previous Overall	Previous Date	Overall Limit	Percent of Limit	Band(s) Exceeded	
Oil Pump Horiz	1	0.8473	in/sec	0	No data	0.6	141.2	*
Oil Pump Horiz Accel	1	7.478	g's	0	No data	25	29.9	
Oil Pump Vert	1	1.014	in/sec	0	No data	0.6	168.9	*
Oil Pump Vert Accel	1	12.8	g's	0	No data	25	51.2	
Oil Pump Axial	1	0.7938	in/sec	0	No data	0.6	132.3	*
Oil Pump Axial Accel	1	8.174	g's	0	No data	25	32.7	
Water Pump Horiz	1	1.342	in/sec	0	No data	0.6	223.7	*
Water Pump Horiz Accel	1	4.129	g's	0	No data	25	16.5	
Water Pump Vert	1	0.7445	in/sec	0	No data	0.6	124.1	*
Water Pump Vert Accel	1	6.976	g's	0	No data	25	27.9	
Water Pump Axial	1	1.242	in/sec	0	No data	0.6	207.1	*
Water Pump Axial Accel	1	5.748	g's	0	No data	25	23.0	
Aux H2O Pump Horiz	1	1.963	in/sec	0	No data	0.6	327.1	*
Aux H2O Pump Horiz Accel	1	4.309	g's	0	No data	25	17.2	
Aux H2O Pump Vert	1	2.292	in/sec	0	No data	0.6	382.0	*
Aux H2O Pump Vert Accel	1	4.726	g's	0	No data	25	18.9	
Aux H2O Pump Axial	1	1.278	in/sec	0	No data	0.6	213.0	*
Aux H2O Pump Axial Accel	1	5.051	g's	0	No data	25	20.2	
Left Turbo Accel	1	3.241	g's	0	No data	6	54.0	
Left Turbo Vel Low Fmax	1	1.509	in/sec	0	No data	6	25.2	
Left Turbo Vel	1	1.382	in/sec	0	No data	0.6	230.3	*
Right Turbo Accel	1	2.703	g's	0	No data	6	45.0	
Right Turbo Vel Low Fmax	1	1.674	in/sec	0	No data	6	27.9	
Right Turbo Vel	1	1.556	in/sec	0	No data	0.6	259.4	*
Eng Main Brg #1	1	2.057	g's	0	No data	2.5	82.3	
Eng Main Brg #1 Vel	1	0.3722	in/sec	0	No data	0.65	57.3	
Eng Main Brg #2	1	1.358	g's	0	No data	2.5	54.3	
Eng Main Brg #2 Vel	1	0.3343	in/sec	0	No data	0.65	51.4	
Eng Main Brg #3	1	1.509	g's	0	No data	2.5	60.4	
Eng Main Brg #3 Vel	1	0.4131	in/sec	0	No data	0.65	63.5	
Eng Main Brg #4	1	1.302	g's	0	No data	2.5	52.1	
Eng Main Brg #4 Vel	1	0.4981	in/sec	0	No data	0.65	76.6	
Eng Main Brg #5	1	1.146	g's	0	No data	2.5	45.8	
Eng Main Brg #5 Vel	1	0.498	in/sec	0	No data	0.65	76.6	
Eng Main Brg #6	1	1.214	g's	0	No data	2.5	48.6	
Eng Main Brg #6 Vel	1	0.4286	in/sec	0	No data	0.65	65.9	
Eng Main Brg #7	1	1.128	g's	0	No data	2.5	45.1	
Eng Main Brg #7 Vel	1	0.4404	in/sec	0	No data	0.65	67.8	
Gen Front Main Brg Horiz	1	0.5156	g's	0	No data	3.5	14.7	
Gen Front Main Brg Horiz Vel	1	0.6442	in/sec	0	No data	0.65	99.1	
Gen Front Main Brg Vert	1	0.8092	g's	0	No data	3.5	23.1	
Gen Front Main Brg Vert Vel	1	0.7971	in/sec	0	No data	0.65	122.6	*
Gen Rear Main Brg Horiz	1	0.4382	g's	0	No data	3.5	12.5	
Gen Rear Main Brg Horiz Vel	1	0.4146	in/sec	0	No data	0.65	63.8	
Gen Rear Main Brg Vert	1	0.55	g's	0	No data	3.5	15.7	
Gen Rear Main Brg Vert Vel	1	0.3029	in/sec	0	No data	0.65	46.6	
Gen Rear Main Brg Axial	1	0.6961	g's	0	No data	3.5	19.9	
Gen Rear Main Brg Axial Vel	1	0.5819	in/sec	0	No data	0.3	194.0	*
EFV (Engine Front Vert) Disp	1	59.81	mils	0	No data	8.5	703.6	*
EFV (Engine Front Vert) Vel	1	0.9935	in/sec	0	No data	1.35	73.6	
EFV (Engine Front Vert) Accel	1	0.4731	g's	0	No data	4.04	11.7	
EFH (Engine Front Horiz) Disp	1	3.954	mils	0	No data	8.5	46.5	
EFH (Engine Front Horiz) Vel	1	0.3738	in/sec	0	No data	1.35	27.7	
EFH (Engine Front Horiz) Accel	1	0.6369	g's	0	No data	4.04	15.8	
ERV (Engine Rear Vert) Disp	1	3.555	mils	0	No data	8.5	41.8	
ERV (Engine Rear Vert) Vel	1	0.3551	in/sec	0	No data	1.35	26.3	
ERV (Engine Rear Vert) Accel	1	0.5061	g's	0	No data	4.04	12.5	
ERH (Engine Rear Horiz) Disp	1	3.825	mils	0	No data	8.5	45.0	
ERH (Engine Rear Horiz) Vel	1	0.4525	in/sec	0	No data	1.35	33.5	
ERH (Engine Rear Horiz) Accel	1	0.6412	g's	0	No data	4.04	15.9	
ERA (Engine Rear Axial) Disp	1	3.628	mils	0	No data	8.5	42.7	
ERA (Engine Rear Axial) Vel	1	0.3814	in/sec	0	No data	1.35	28.2	
ERA (Engine Rear Axial) Accel	1	1.059	g's	0	No data	4.04	26.2	
XFV (Gen Front Vert) Disp	1	4.828	mils	0	No data	8.5	56.8	
XFV (Gen Front Vert) Vel	1	0.9131	in/sec	0	No data	1.35	67.6	
XFV (Gen Front Vert) Accel	1	1.075	g's	0	No data	4.04	26.6	

\* Overall Vibration Limit Exceeded



Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

Vibration Report - Page 2

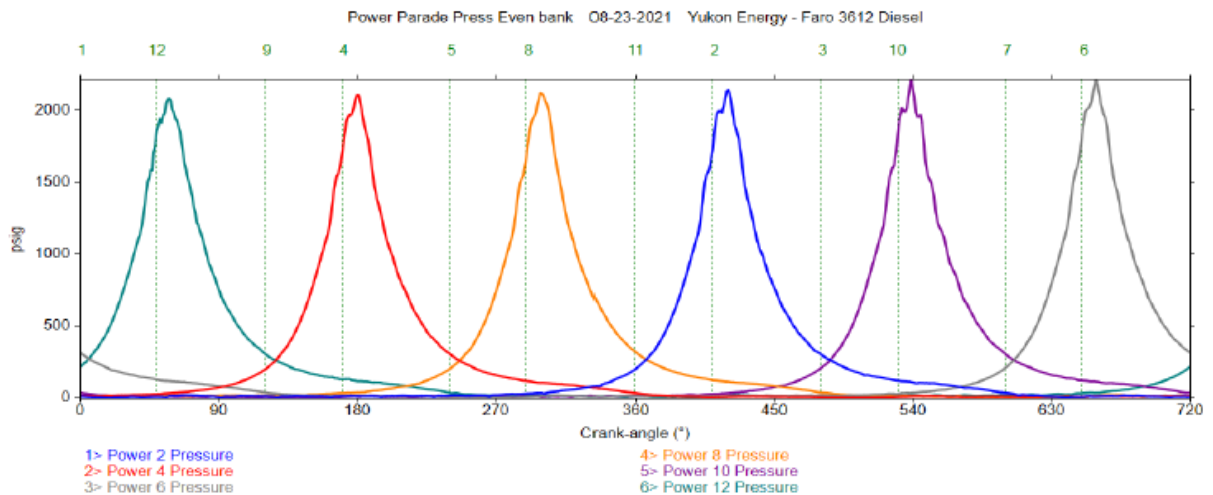
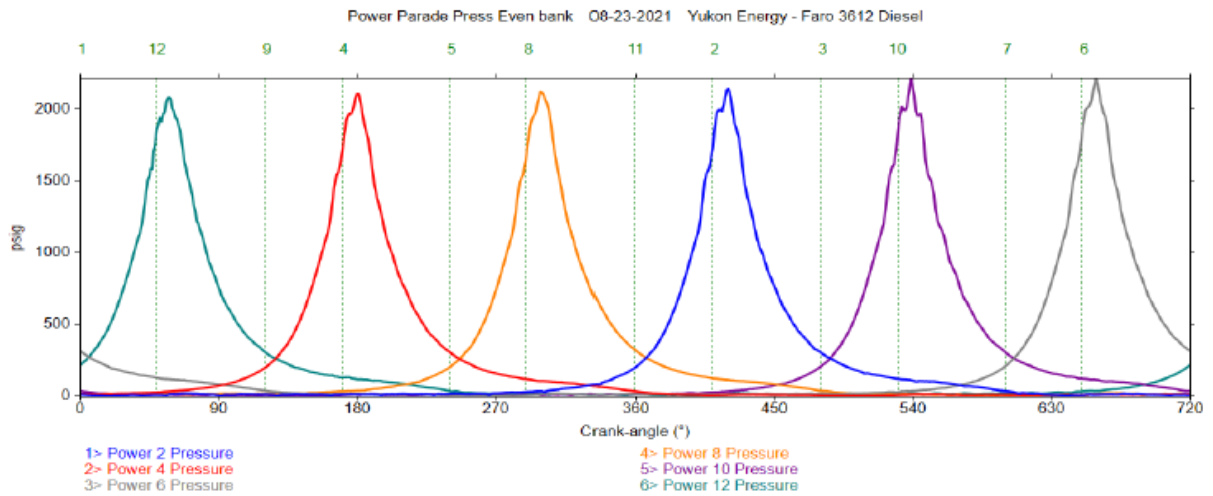
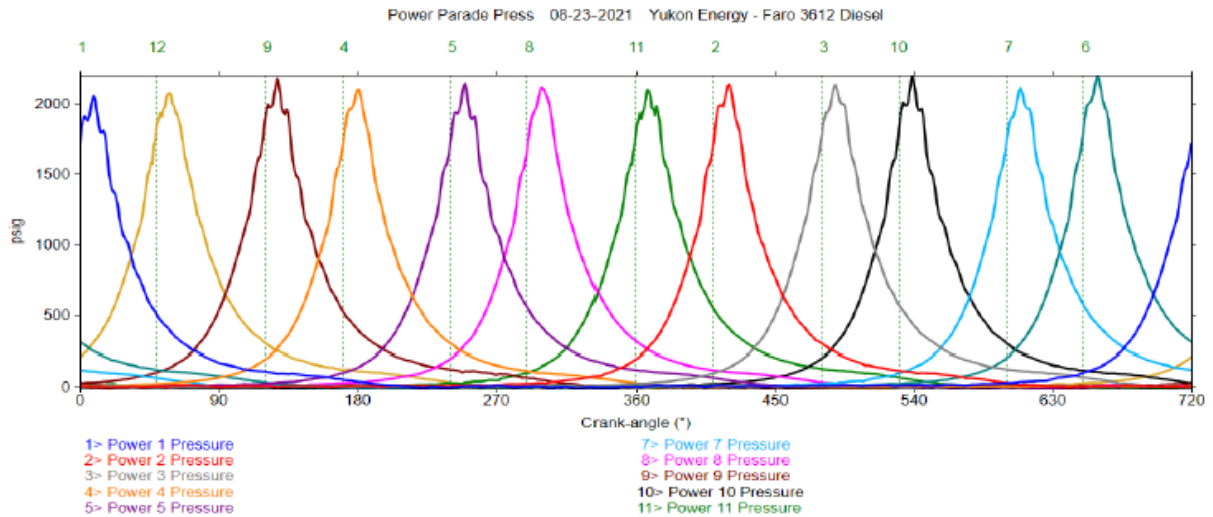
Point Description	Channel Number	Current Overall	Previous Overall	Previous Date	Overall Limit	Percent of Limit	Band(s) Exceeded
XFH (Gen Front Horiz) Disp	1	4.943	mils	0	No data	8.5	58.1
XFH (Gen Front Horiz) Vel	1	0.5879	in/sec	0	No data	1.35	43.5
XFH (Gen Front Horiz) Accel	1	0.5675	g's	0	No data	4.04	14.0
XRV (Gen Rear Vert) Disp	1	4.489	mils	0	No data	8.5	52.8
XRV (Gen Rear Vert) Vel	1	0.4622	in/sec	0	No data	1.35	34.2
XRV (Gen Rear Vert) Accel	1	0.607	g's	0	No data	4.04	15.0
XRH (Gen Rear Horiz) Disp	1	3.881	mils	0	No data	8.5	45.7
XRH (Gen Rear Horiz) Vel	1	0.5733	in/sec	0	No data	1.35	42.5
XRH (Gen Rear Horiz) Accel	1	0.6337	g's	0	No data	4.04	15.7
XRA (Gen Rear Axial) Disp	1	3.397	mils	0	No data	8.5	40.0
XRA (Gen Rear Axial) Vel	1	0.6547	in/sec	0	No data	1.35	48.5
XRA (Gen Rear Axial) Accel	1	0.8075	g's	0	No data	4.04	20.0
Eng Frame Lft Frt Horiz Vel	1	0.4251	in/sec	0	No data	0.65	65.4
Eng Frame Lft Frt Vert Vel	1	0.4171	in/sec	0	No data	0.65	64.2
Eng Frame Lft Frt Axl Vel	1	0.2433	in/sec	0	No data	0.3	81.1
Skid Frame Lft Frt Horiz Vel	1	0.4672	in/sec	0	No data	0.65	71.9
Skid Frame Lft Frt Vert Vel	1	0.5003	in/sec	0	No data	0.65	77.0
Skid Frame Lft Frt Axl Vel	1	0.2781	in/sec	0	No data	0.3	92.7
Eng Frame Left Rear Horiz Vel	1	0.4879	in/sec	0	No data	0.65	75.1
Eng Frame Left Rear Vert Vel	1	0.3234	in/sec	0	No data	0.65	49.7
Eng Frame Left Rear Axl Vel	1	0.2716	in/sec	0	No data	0.3	90.5
Skid Frame Lft Rr Eng Horiz	1	0.4576	in/sec	0	No data	0.65	70.4
Skid Frame Lft Rr Eng Vert	1	0.3993	in/sec	0	No data	0.65	61.4
Skid Frame Lft Rr Eng Axial	1	0.297	in/sec	0	No data	0.3	99.0
Gen Frame Lft Frt Horiz Vel	1	0.4141	in/sec	0	No data	0.65	63.7
Gen Frame Lft Frt Vert Vel	1	<b>0.7055</b>	in/sec	0	No data	<b>0.65</b>	<b>108.5</b>
Gen Frame Lft Frt Axl Vel	1	<b>0.4211</b>	in/sec	0	No data	<b>0.3</b>	<b>140.4</b>
Skid Frm Left Frnt Gen Horiz	1	0.3251	in/sec	0	No data	0.65	50.0
Skid Frm Left Frnt Gen Vert	1	<b>0.6725</b>	in/sec	0	No data	<b>0.65</b>	<b>103.5</b>
Skid Frm Left Frnt Gen Axl	1	<b>0.3078</b>	in/sec	0	No data	<b>0.3</b>	<b>102.6</b>
Gen Frame Left Rear Horiz Vel	1	0.394	in/sec	0	No data	0.65	60.6
Gen Frame Left Rear Vert Vel	1	0.5717	in/sec	0	No data	0.65	88.0
Gen Frame Left Rear Axl Vel	1	<b>0.4436</b>	in/sec	0	No data	<b>0.3</b>	<b>147.9</b>
Skid Frame Left Rear Horiz Vel	1	0.4041	in/sec	0	No data	0.65	62.2
Skid Frame Left Rear Vert Vel	1	0.5822	in/sec	0	No data	0.65	89.6
Skid Frame Left Rear Axl Vel	1	<b>0.3697</b>	in/sec	0	No data	<b>0.3</b>	<b>123.2</b>
Eng Frame Rt Frnt Horiz izVel	1	0.433	in/sec	0	No data	0.65	66.6
Eng Frame Rt Frnt Vert Vel	1	0.4676	in/sec	0	No data	0.65	71.9
Eng Frame Rt Frnt Axl Vel	1	0.227	in/sec	0	No data	0.3	75.7
Skid Frame Rt Front Horiz Vel	1	0.3799	in/sec	0	No data	0.65	58.5
Skid Frame Rt Front Vert Vel	1	0.4689	in/sec	0	No data	0.65	72.1
Skid Frame Rt Front Axl Vel	1	0.2742	in/sec	0	No data	0.3	91.4
Eng Frame RT Rear Horiz Vel	1	0.4474	in/sec	0	No data	0.65	68.8
Eng Frame RT Rear Vert Vel	1	0.297	in/sec	0	No data	0.65	45.7
Eng Frame RT Rear Axl Vel	1	0.2714	in/sec	0	No data	0.3	90.5
Skid Frame Rt Rr Eng Horiz	1	0.3877	in/sec	0	No data	0.65	59.6
Skid Frame Rt Rr Eng Vert	1	0.2844	in/sec	0	No data	0.65	43.8
Skid Frame Rt Rr Eng Axial	1	0.2702	in/sec	0	No data	0.3	90.1
Gen Frame Rt Front Horiz Vel	1	<b>0.6841</b>	in/sec	0	No data	<b>0.65</b>	<b>105.3</b>
Gen Frame Rt Fnt Vret Vel	1	<b>0.7113</b>	in/sec	0	No data	<b>0.65</b>	<b>109.4</b>
Gen Frame Rt Front Axl Vel	1	<b>0.3754</b>	in/sec	0	No data	<b>0.3</b>	<b>125.1</b>
Skid Frm Rt Frnt Gen Ft Horiz	1	0.5731	in/sec	0	No data	0.65	88.2
Skid Frm Rt Frnt Gen Ft Vert	1	0.6167	in/sec	0	No data	0.65	94.9
Skid Frm Rt Frnt Gen Ft Axl	1	<b>0.3599</b>	in/sec	0	No data	<b>0.3</b>	<b>120.0</b>
Gen Frame Rt Rear Horiz Vel	1	0.3443	in/sec	0	No data	0.65	53.0
Gen Frame Rt Rear Vert Vel	1	0.592	in/sec	0	No data	0.65	91.1
Gen Frame Rt Rear Axl Vel	1	<b>0.4095</b>	in/sec	0	No data	<b>0.3</b>	<b>136.5</b>
Skid Frame Rt Rear Horiz Vel	1	0.3661	in/sec	0	No data	0.65	56.3
Skid Frame Rt Rear Vert Vel	1	0.6247	in/sec	0	No data	0.65	96.1
Skid Frame Rt Rear Axl Vel	1	<b>0.3928</b>	in/sec	0	No data	<b>0.3</b>	<b>130.9</b>
X Phased Eng-Gen Horiz Vel	1	0.438	in/sec	0	No data	0.5	87.6
X Phased Eng-Gen Horiz Vel	2	<b>0.6975</b>	in/sec	0	No data	<b>0.5</b>	<b>139.5</b>
X Phased Eng-Gen Vert Vel	1	0.3322	in/sec	0	No data	0.5	66.4
X Phased Eng-Gen Vert Vel	2	0.2961	in/sec	0	No data	0.5	59.2
X Phased Eng NDE-DE Horiz Vel	1	0.2908	in/sec	0	No data	0.5	58.2
X Phased Eng NDE-DE Horiz Vel	2	0.2223	in/sec	0	No data	0.5	44.5
X Phase Gen NDE-DE Horiz Vel	1	0.398	in/sec	0	No data	0.5	79.6
X Phase Gen NDE-DE Horiz Vel	2	<b>0.6743</b>	in/sec	0	No data	<b>0.5</b>	<b>134.9</b>

\* Overall Vibration Limit Exceeded



Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

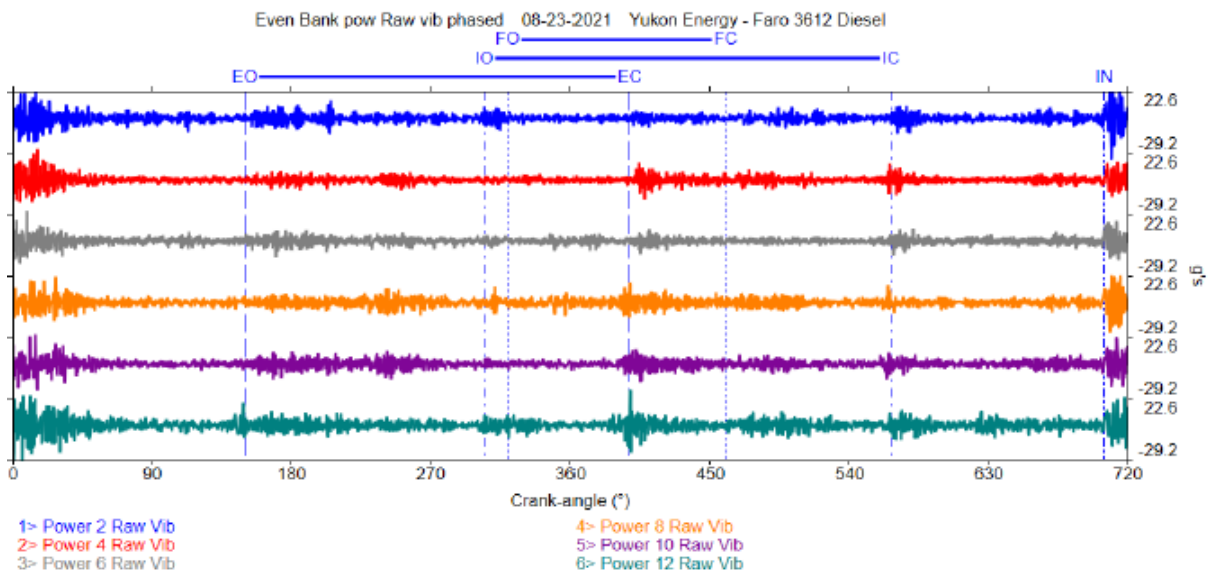
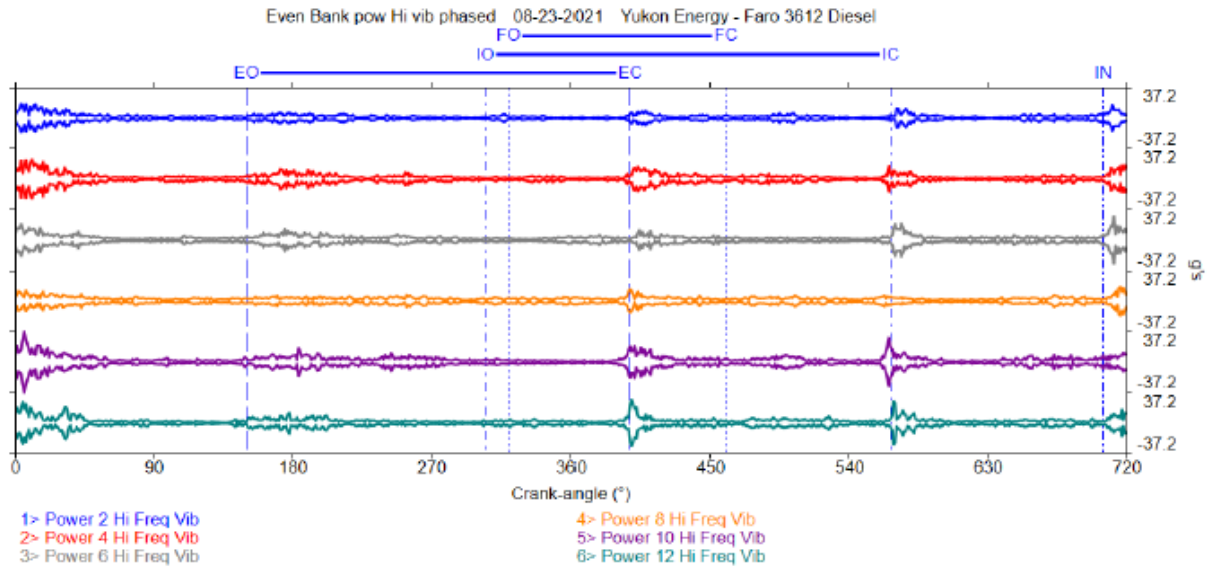
### Power Cylinder Peak Firing Pressure Parade





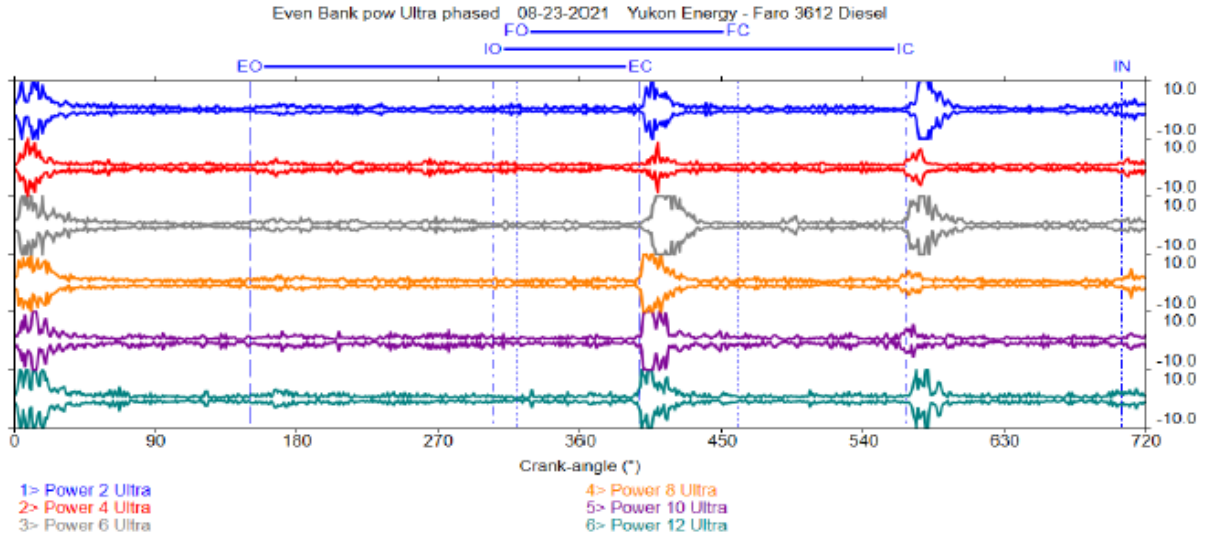
Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

### Even Bank Vibration and Ultrasonic Traces

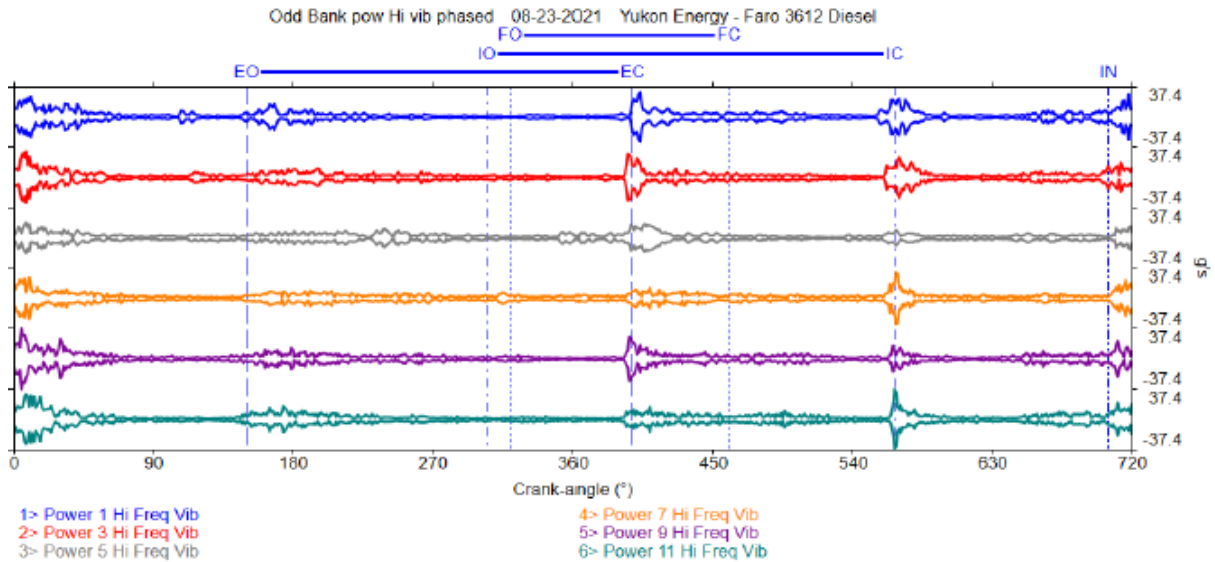




### Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

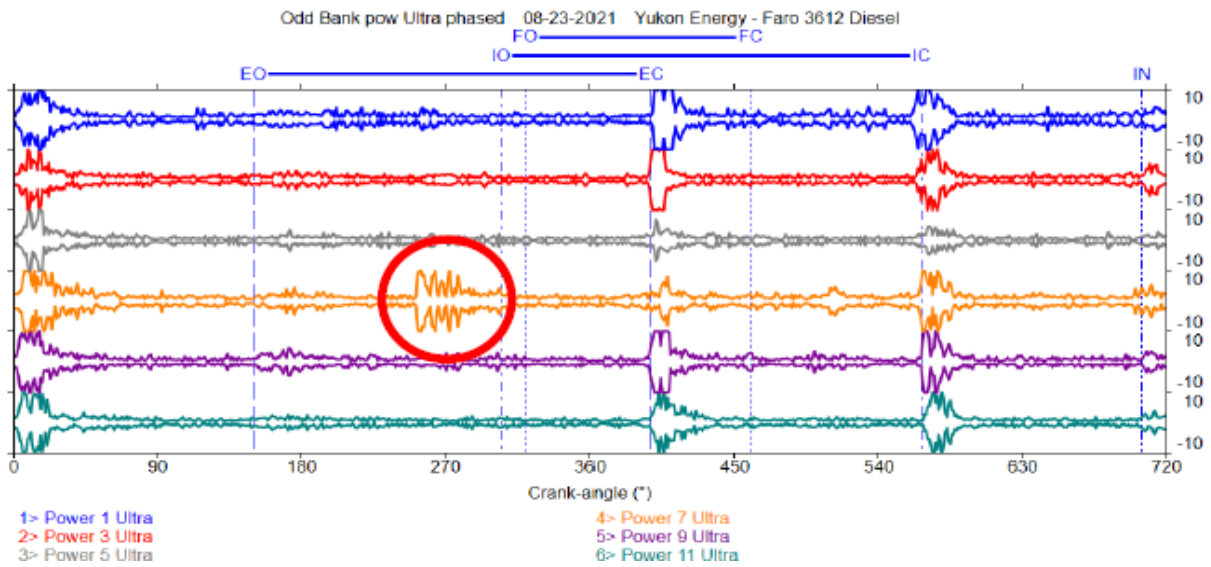
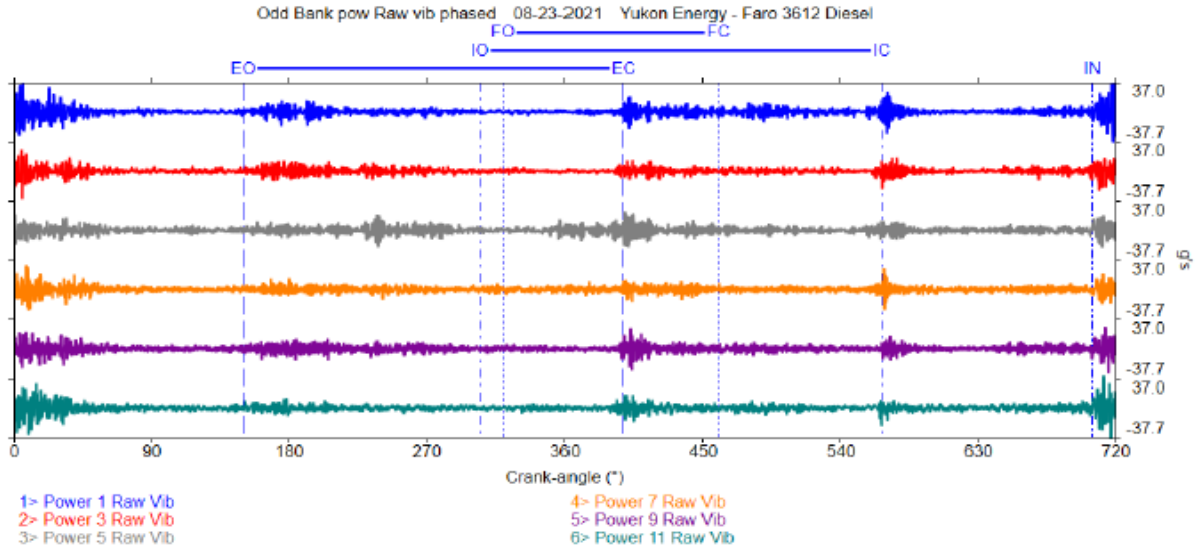


### Odd Bank Vibration and Ultrasonic Traces





### Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

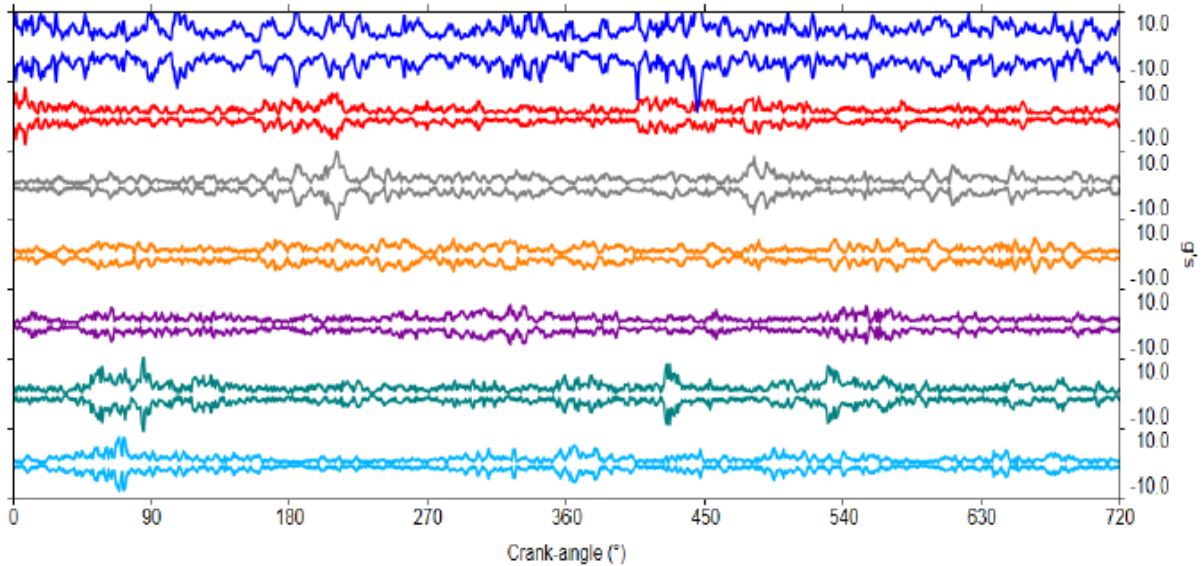




Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

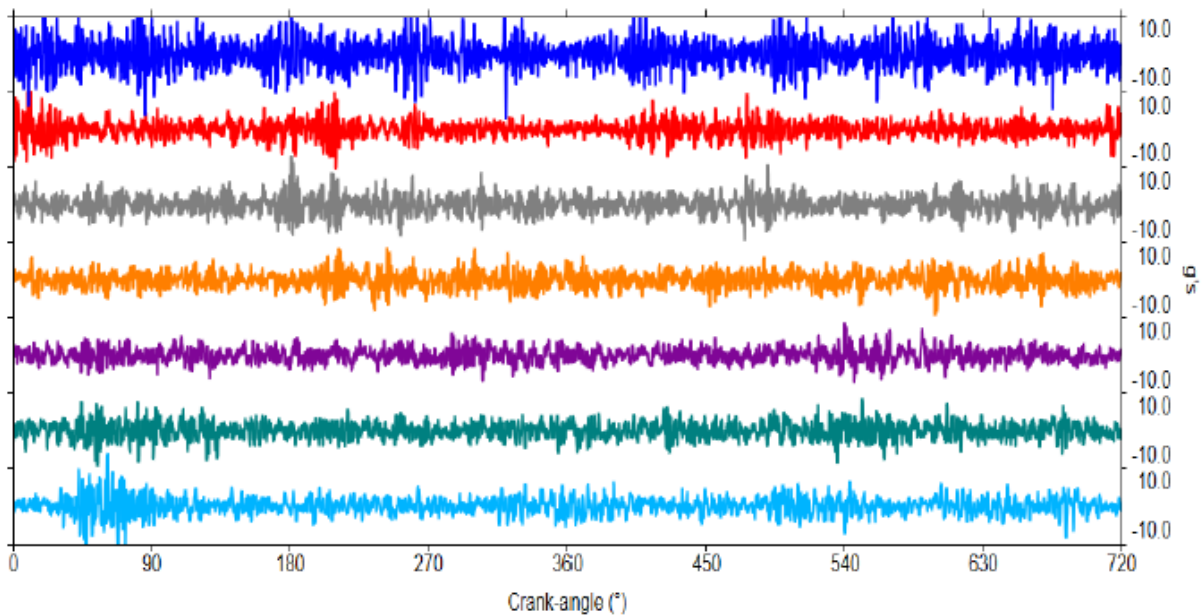
### Engine Main Bearing Vibration Traces

Eng Main Bear Hi Vib Phased G1 08-23-2021 Yukon Energy - Faro 3612 Diesel



- 1-> Main Bear 1 Hi Freq Vib
- 2-> Main Bear 2 Hi Freq Vib
- 3-> Main Bear 3 Hi Freq Vib
- 4-> Main Bear 4 Hi Freq Vib
- 5-> Main Bear 5 Hi Freq Vib
- 6-> Main Bear 6 Hi Freq Vib
- 7-> Main Bear 7 Hi Freq Vib

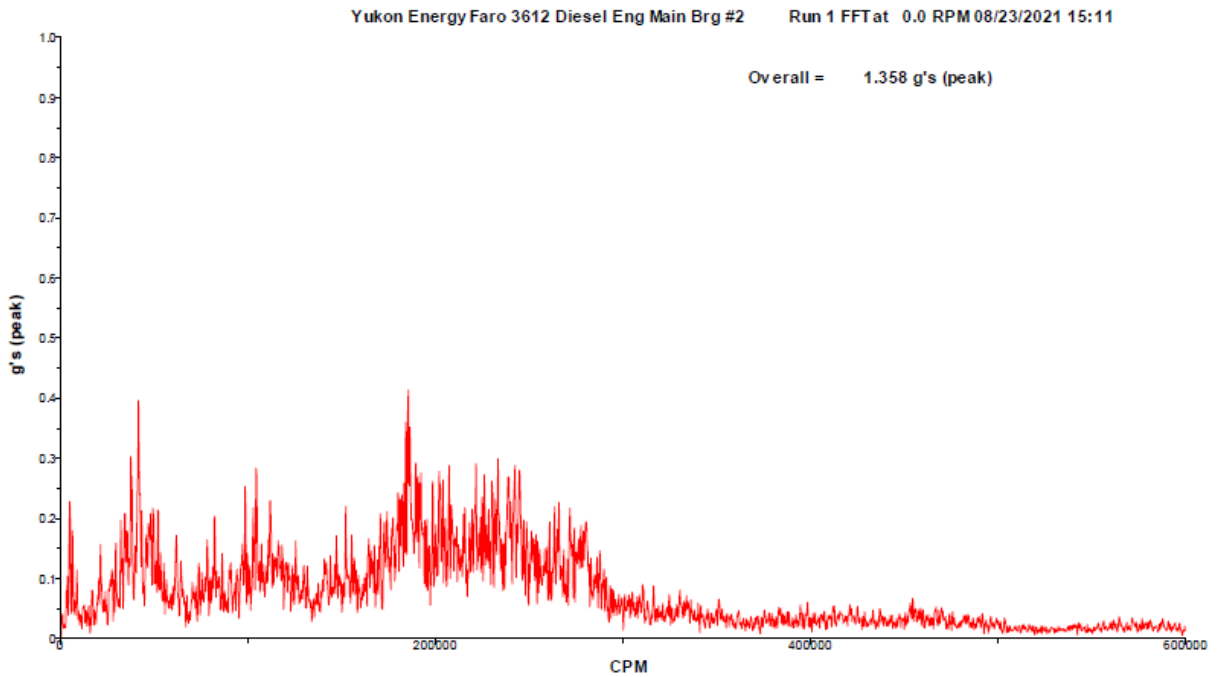
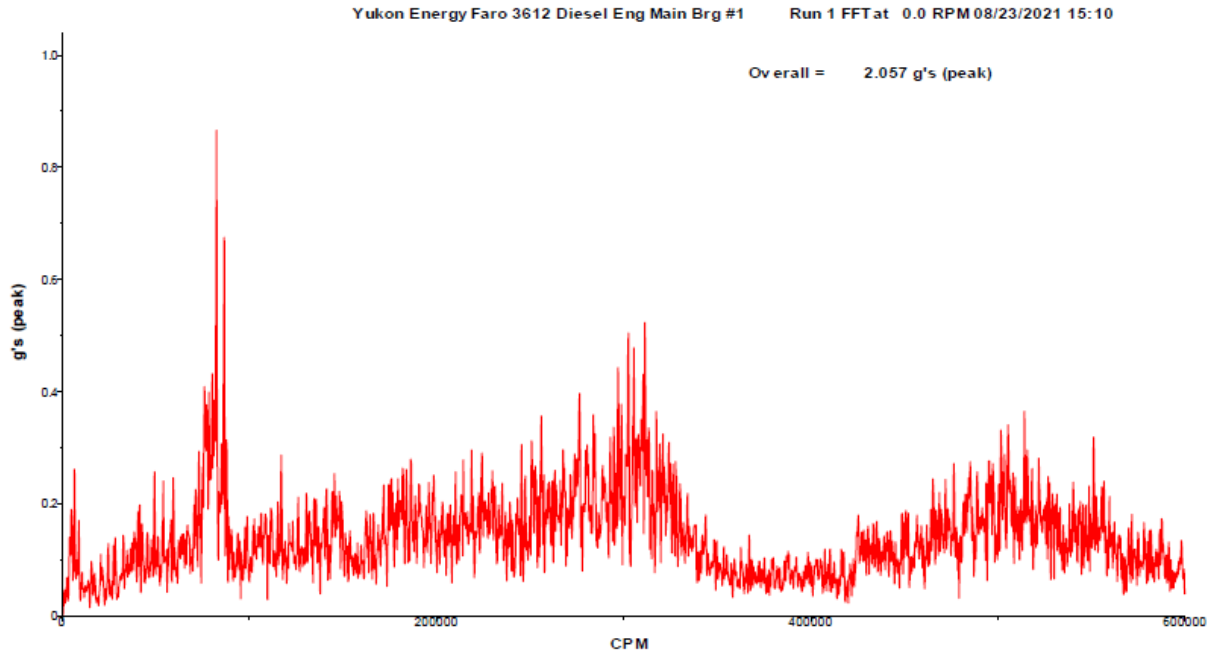
Eng Main Bear Raw Vib Phase G1 08-23-2021 Yukon Energy - Faro 3612 Diesel



- 1-> Main Bear 1 Raw Vib
- 2-> Main Bear 2 Raw Vib
- 3-> Main Bear 3 Raw Vib
- 4-> Main Bear 4 Raw Vib
- 5-> Main Bear 5 Raw Vib
- 6-> Main Bear 6 Raw Vib
- 7-> Main Bear 7 Raw Vib

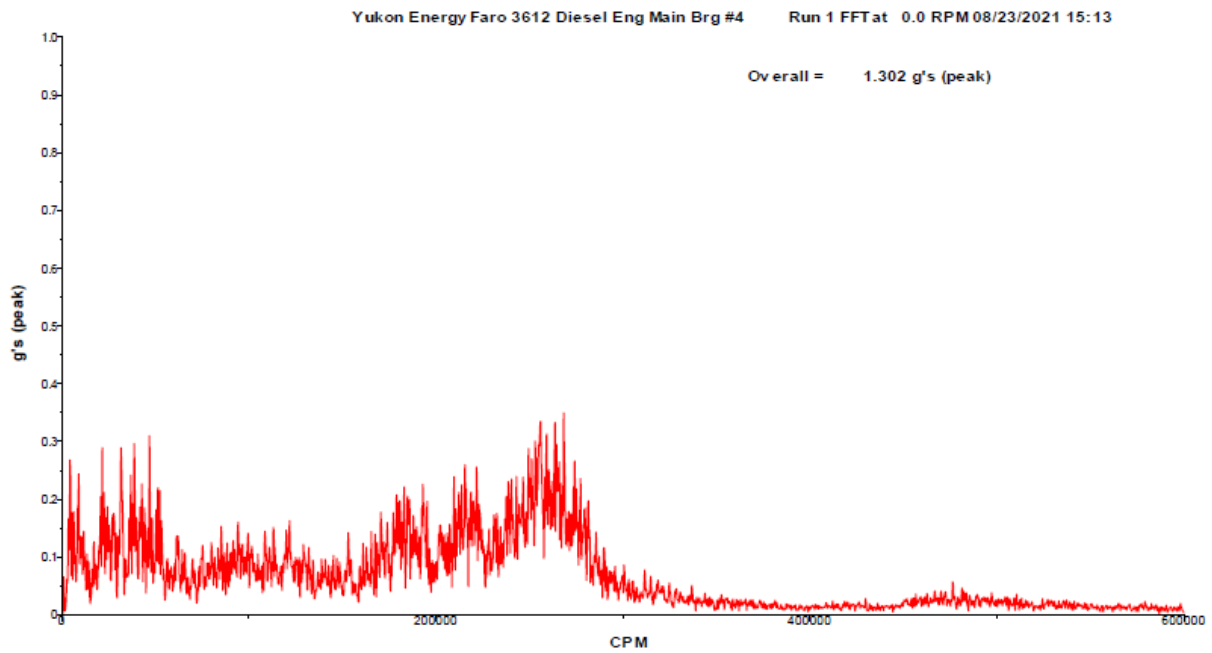
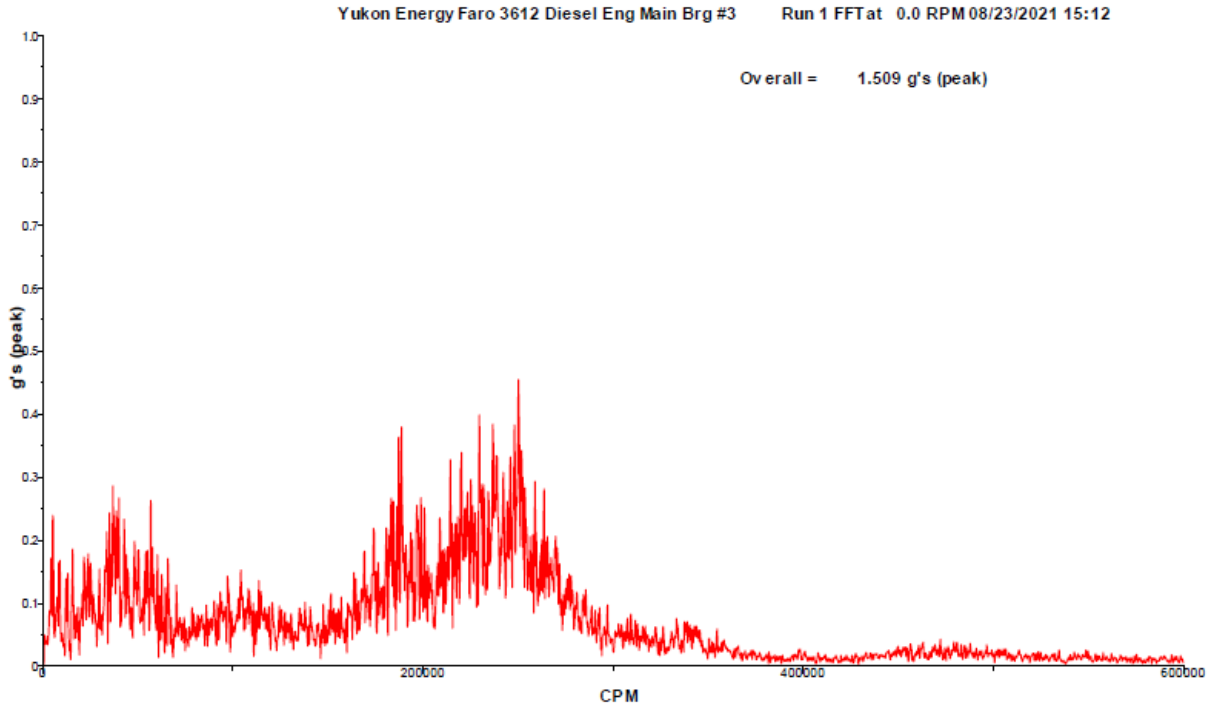


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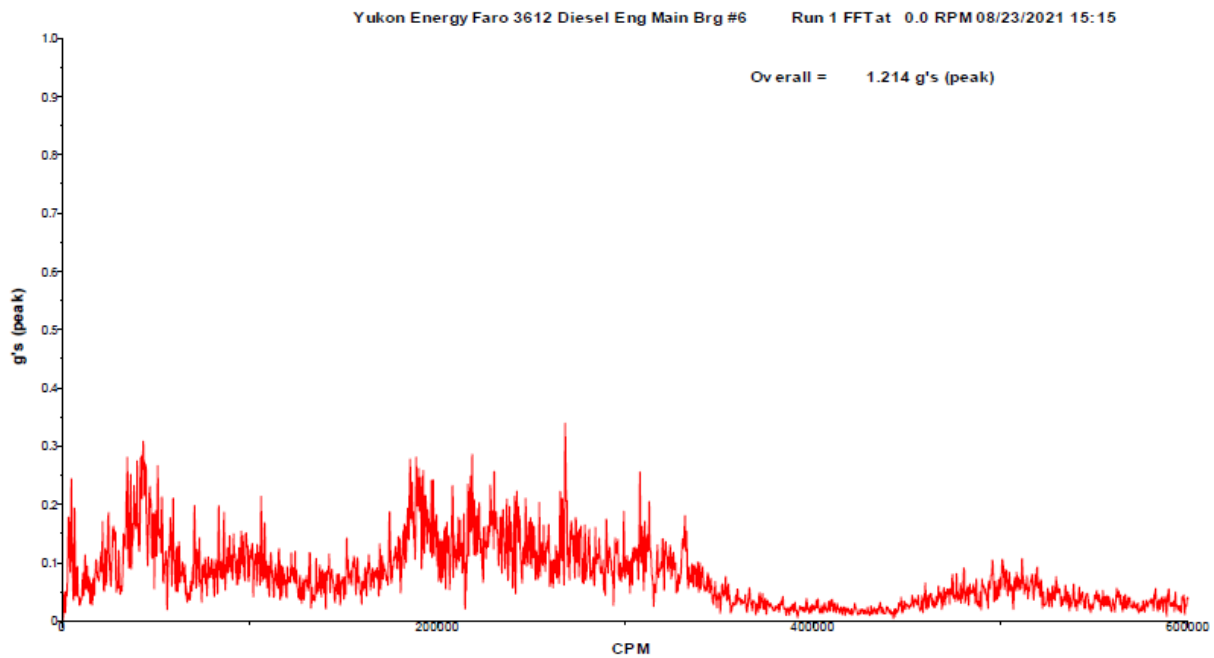
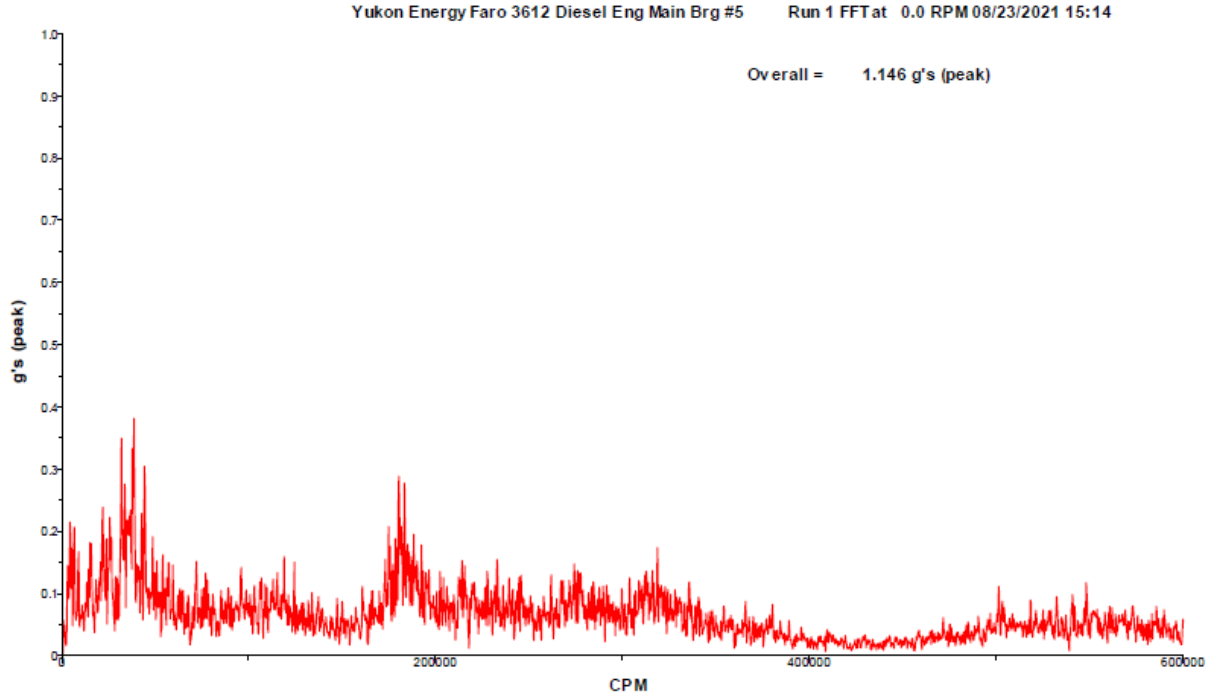


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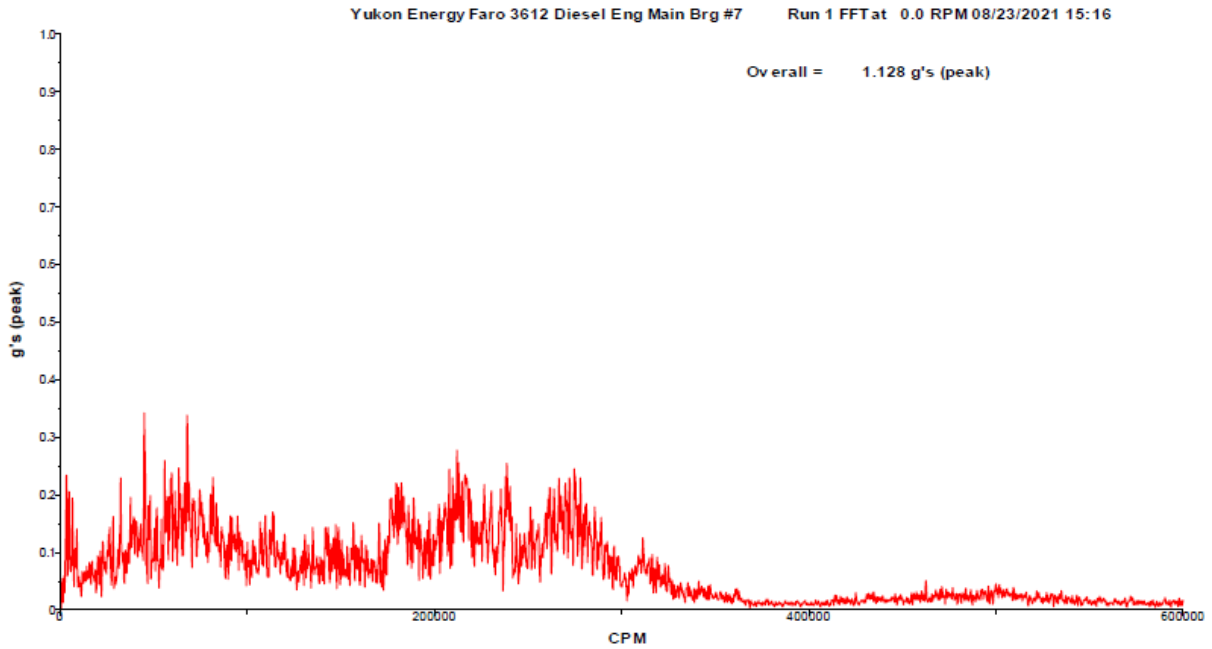


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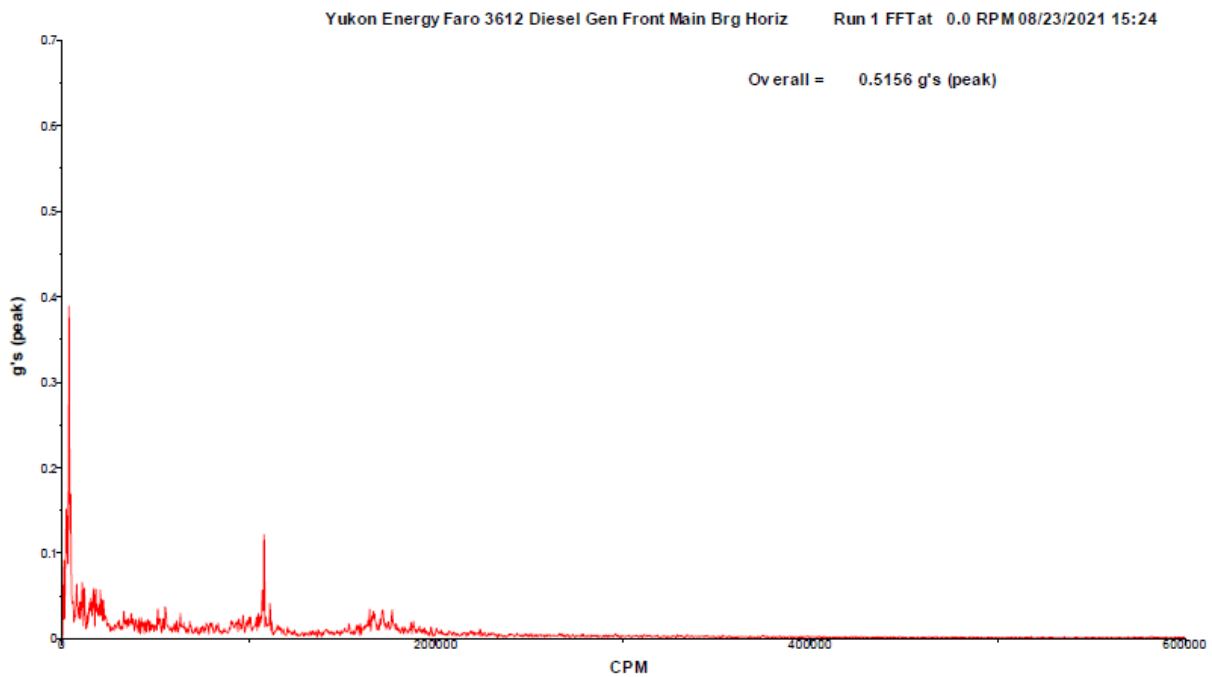




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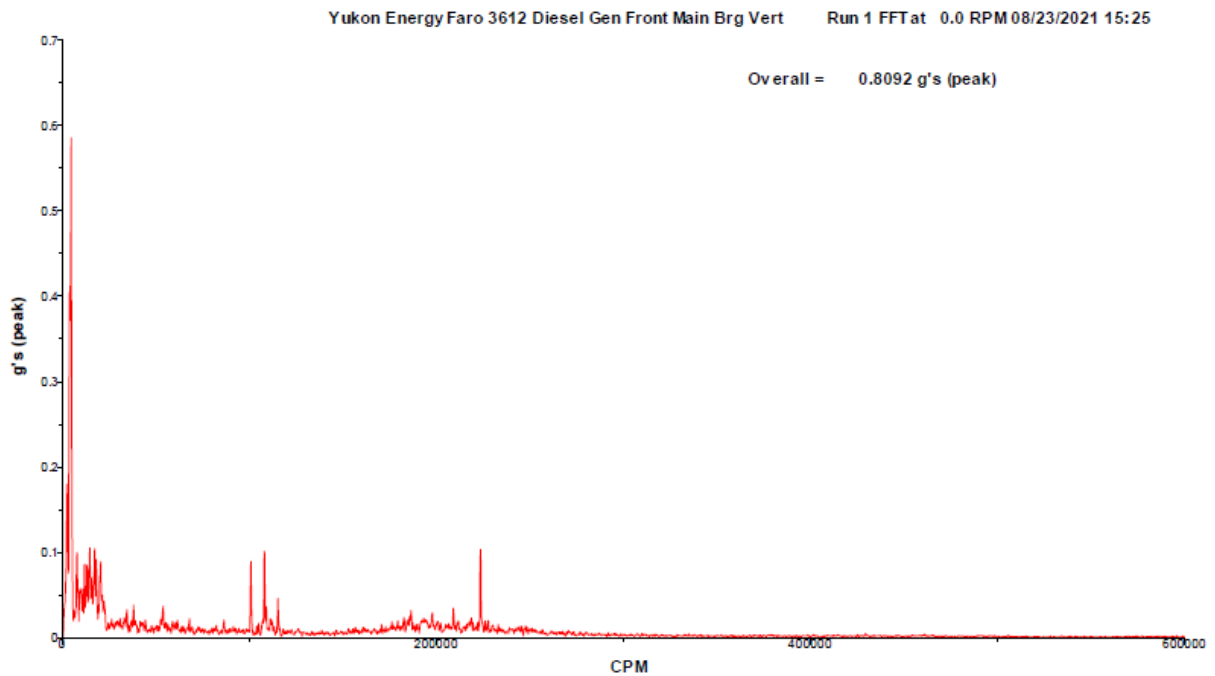
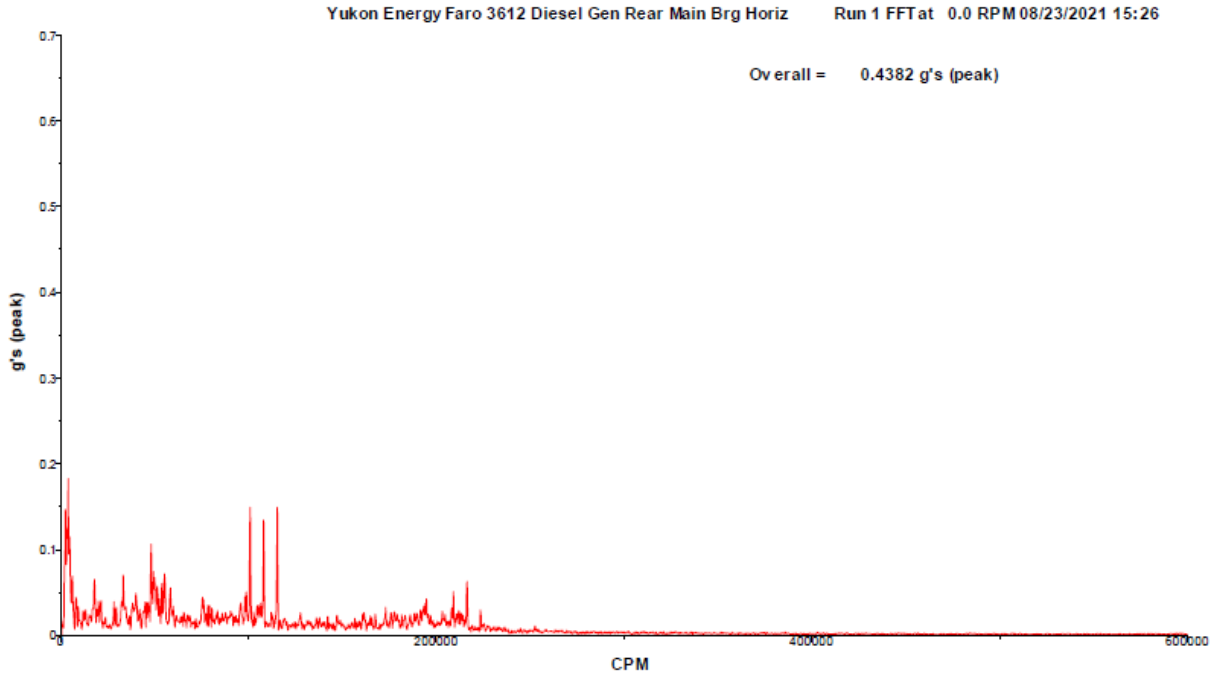


### Generator Bearing Vibration Data





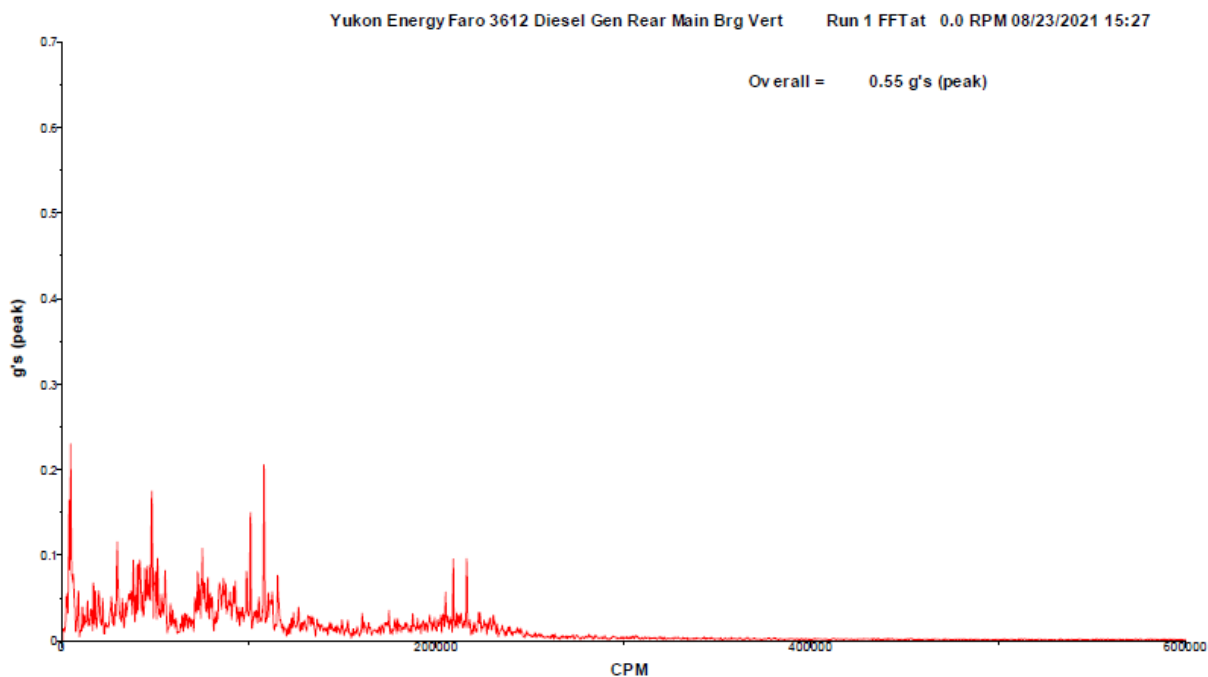
### Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071





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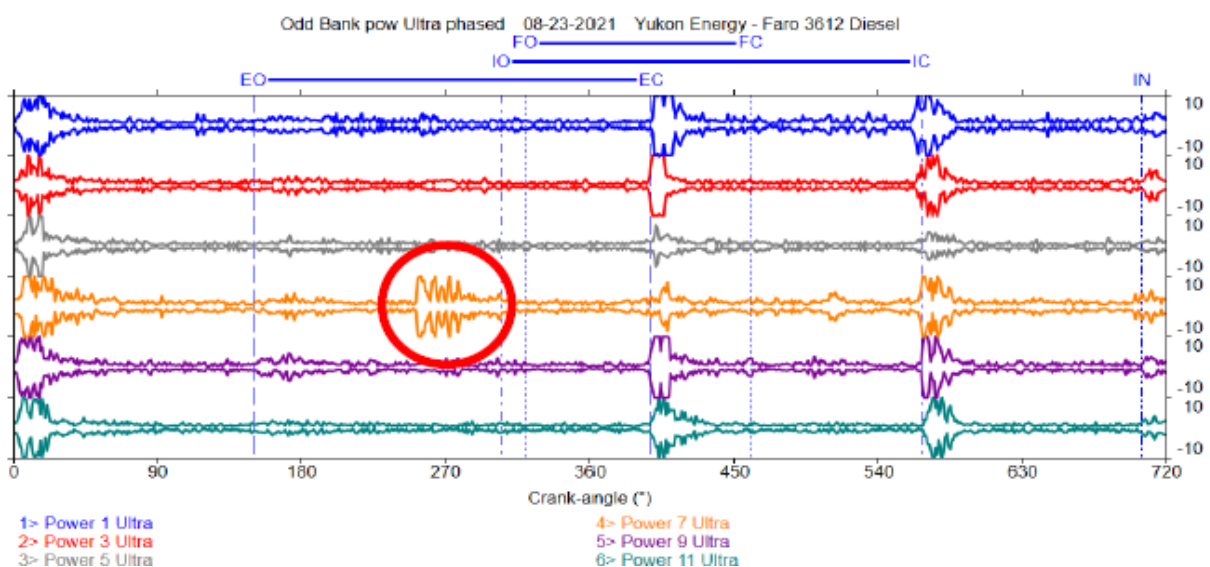
## Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

### Summary:

- The performance and vibration data indicated that the unit is in good condition
- The power cylinder peak firing pressures are consistent across all 12 cylinders indicating even wear across the engine
- There was not any evidence of excessive blow by at the piston rings
- Intake and exhaust valve closure events indicate that the valve adjustments are within spec
- The connecting rod and main bearing vibration are within acceptable levels and consistent when compared across the unit
- The water pumps and oil pump vibration are within acceptable levels and no issues were indicated in the data
- The turbo vibration signatures indicated that the turbos were healthy
- Power cylinder #7 (#4 right bank) has an abnormal ultrasonic event at 270 degrees of crank rotation (mid stroke on exhaust stroke) – Finding #1
- There was a significant temperature difference between the inner and outer vibration dampener noted during the temp survey – Finding #2
- Generator bearing vibration indicates the bearings are in good condition

### Findings:

**#1 Engine**, Power cylinder #7 (#4 right bank) had an ultrasonic event at ~270 that is not evident.





Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

**#2 Engine**, the inner and outer vibration dampeners had a significant temperature difference. Usually, the two dampeners are within 5 – 10 degrees C. Inner temp was 119 degrees, and the outer was 77 degrees.

9> Eng Oil Differential Press kPa	1.100	8-23-21 14:34:41
10> Block Temp	190.00	8-23-21 14:38:38
11> Inner Damper Temp	119.00	8-23-21 14:37:50
12> Outer Damper Temp	77.00	8-23-21 14:38:01
13> Oil Filter Diff Press	1.100	8-23-21 14:35:43
14> Exhaust Temp Cylinder #1	947.02	8-23-21 14:29:59
15> Exhaust Temp Cylinder #2	928.02	8-23-21 14:30:08



Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071



## Faro Yukon – Cat 3612 Generator Inspection Summary

### Sunday Aug 21 – Travel from Red Deer Alberta to Faro Yukon

### Monday Aug 22 – Conditional Monitoring – Test Run

#### Monday AM

Arrived onsite meet with customer rep Gary

Complete site orientation

Meet customer reps Riley and Katherine – unload tools and equipment

Prepared the engine conditional monitoring

#### Monday PM

Completed 4 hr. condition monitoring under load – see additional reports

Items noted during testing:

- Exhaust
  - Exhaust turbo temp sensors are backwards (left and right) – corrected
- Coolant systems
  - Adjusted coolant set points to improve function
    - #1 fan starts at 155°F, #2 fan starts at 160°F, #3 fan starts at 165°F, and #4 starts at 170°F
- Outside Front Vibration Dampener
  - Is not working
- #3 right cylinder runs hotter than the others at start up

Review and complete lock out procedures

Drain coolant prepare engine for dismantling

Disconnected and removed one starter install and connected Collicutt engine baring device

Reviewed conditional monitoring data

- Monitors picked up #4 right cylinder has a slight tap at 270°
  - We selected as target cylinder to dismantle and inspect



Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

**Tuesday Aug 23 – Dismantle and Inspect Cylinder 4 Right**

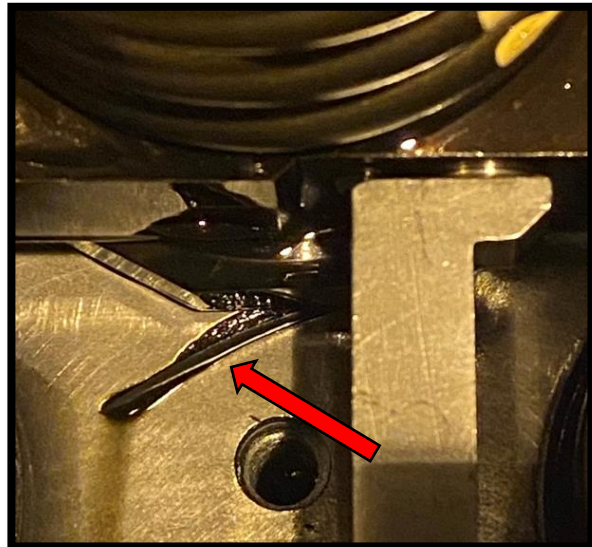
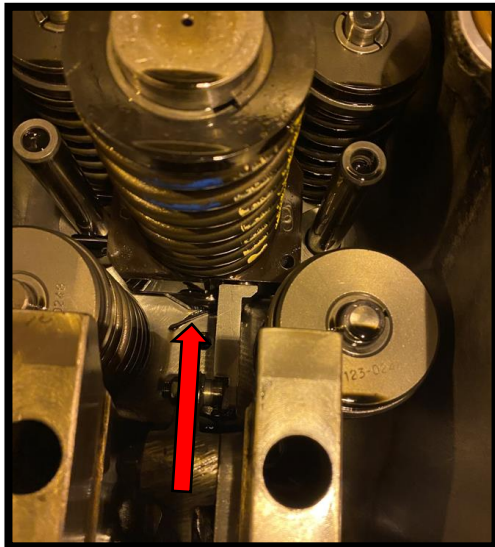
**Tuesday AM**

Drain fuel system

Remove valve covers

Inspected all cylinder heads

- Injectors #1 & #3 left
  - O-rings sheared off from previous install
- Injector #2 right
  - O-ring sheared off and visible
  - Injector spring is broken
    - Replaced with Cat reman injector



*Figure 1- Injector with Sheared O-ring*



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Tuesday AM

Front outer vibration dampener

- Removed Aux In water piping to access vibration dampener guard
  - Noted 7 of 9 broken tabs on guard back and front
    - We repaired by welding tabs back onto the guard

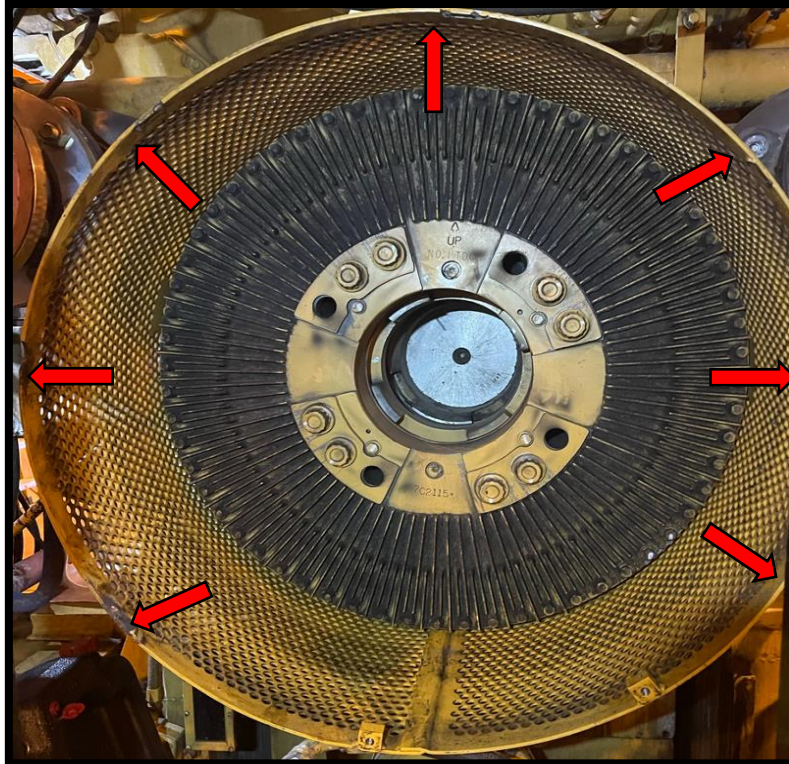
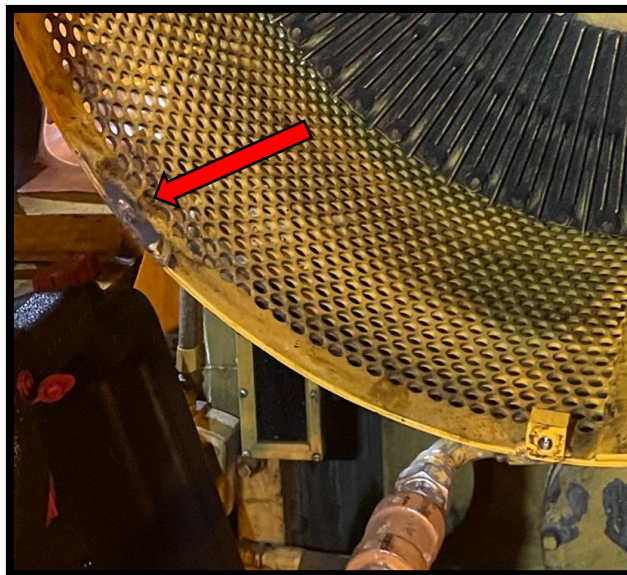


Figure 2- Front Dampener Guard - 7 Broken Tabs

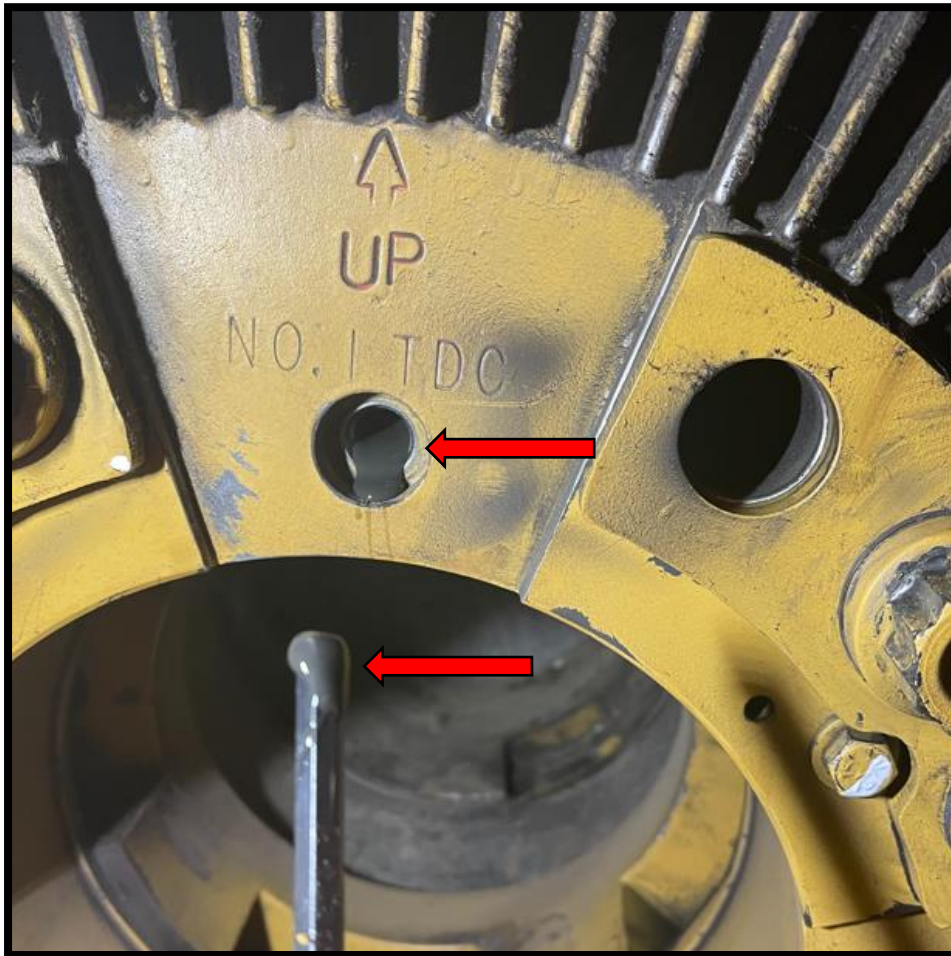




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Tuesday AM

- Removed oil plug and inspected oil
  - Oil is dirty and set up
    - This oil should be clear when in good condition



*Figure 3 - Front Dampener Oil*

#### #4 Right cylinder

- Disconnect and remove coolant piping
- Dismantle and remove exhaust manifold
- Install hydraulic tooling
- Stretch head studs and back off head nuts, remove tooling
- Remove cylinder head
  - Noted some wear in the injector bore
- Inspect deck
  - Good condition



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Tuesday AM

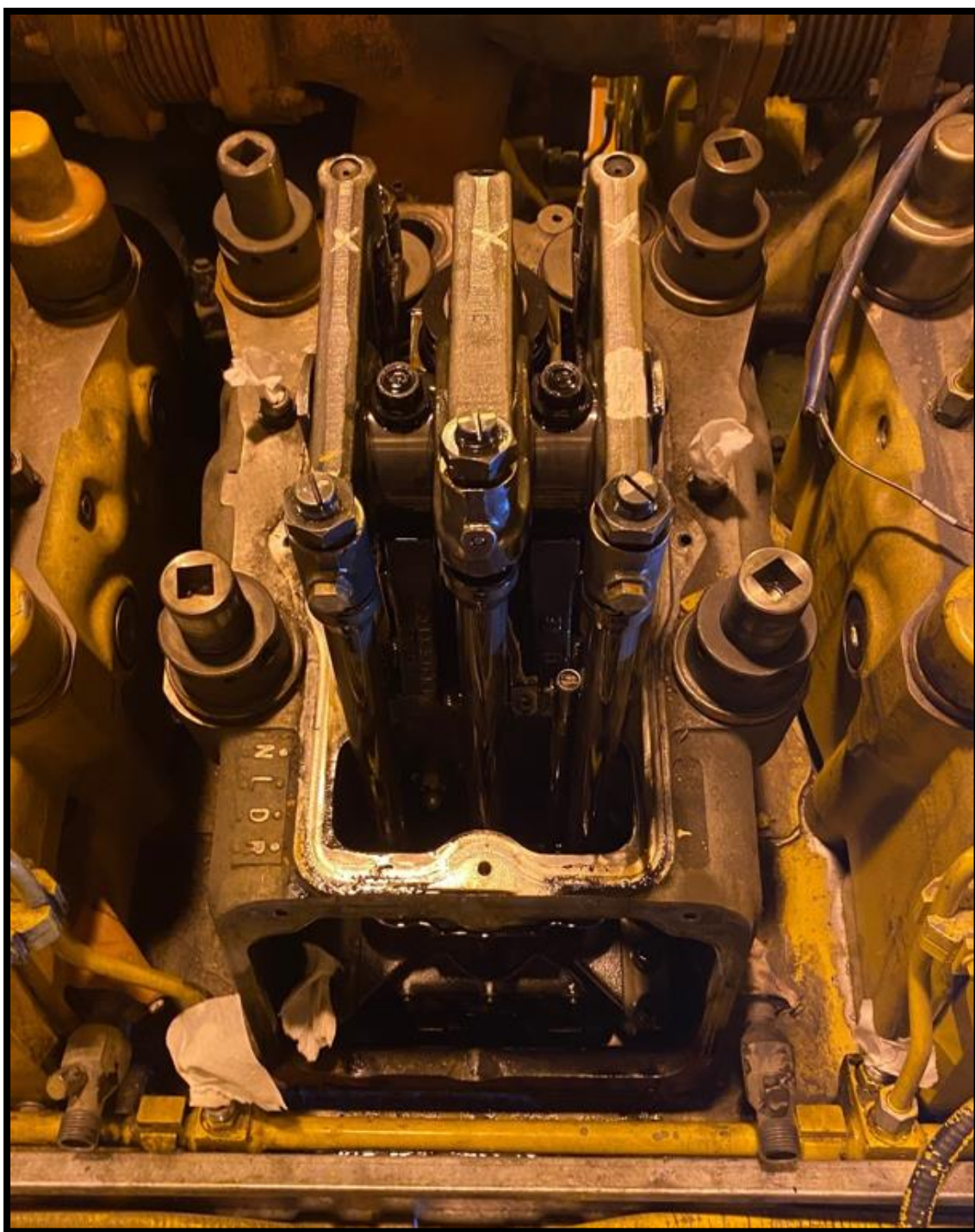


Figure 4 - #4 Right Cylinder Head



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Tuesday AM

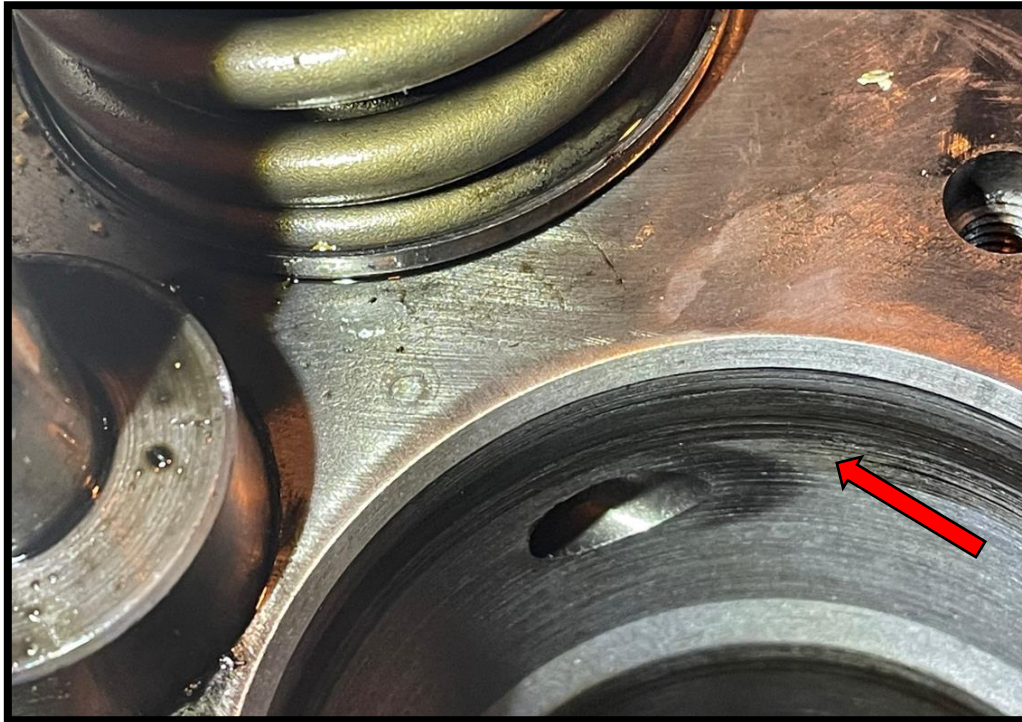


Figure 5- #4 Right Injector Bore

Tuesday PM

#4 Right Cylinder

- Unbolt and removed connecting rod cap
- Removed Piston and Connecting rod
- Wrap crank to protect from contamination
- Inspected liner
  - A little rough appearance
    - Possible it was caused by minor rusting
  - O-rings are in pore condition
- Inspected rod bearings – good condition
- Inspected crank / rod journal – good condition
- Inspect Piston
  - Some carbon build up
  - #3 ring was seized in groove
  - Top ring chrome was flaking off
  - Removed piston rings
  - Cleaned and inspected piston ring grooves
- Drain engine oil from crank case
- Install main bearing stud hydraulic tooling



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Tuesday PM



Figure 6- #4 Right Piston - Seized Third Ring



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Tuesday PM



Figure 7 - #4 Right Piston - Ring with carbon



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Tuesday PM

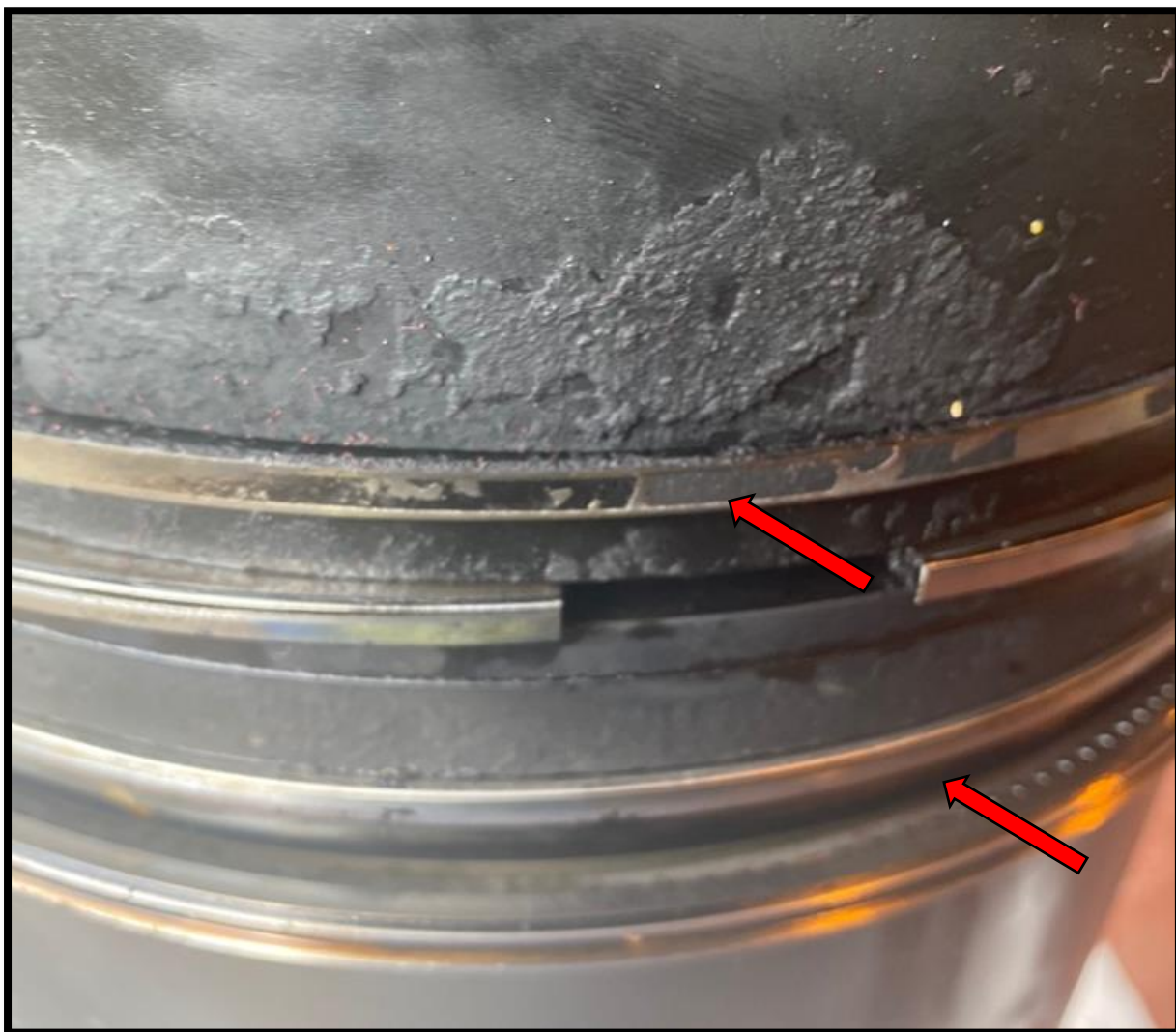


Figure 8- #4 Right Piston – Top Ring Chrome Flaking



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Tuesday PM

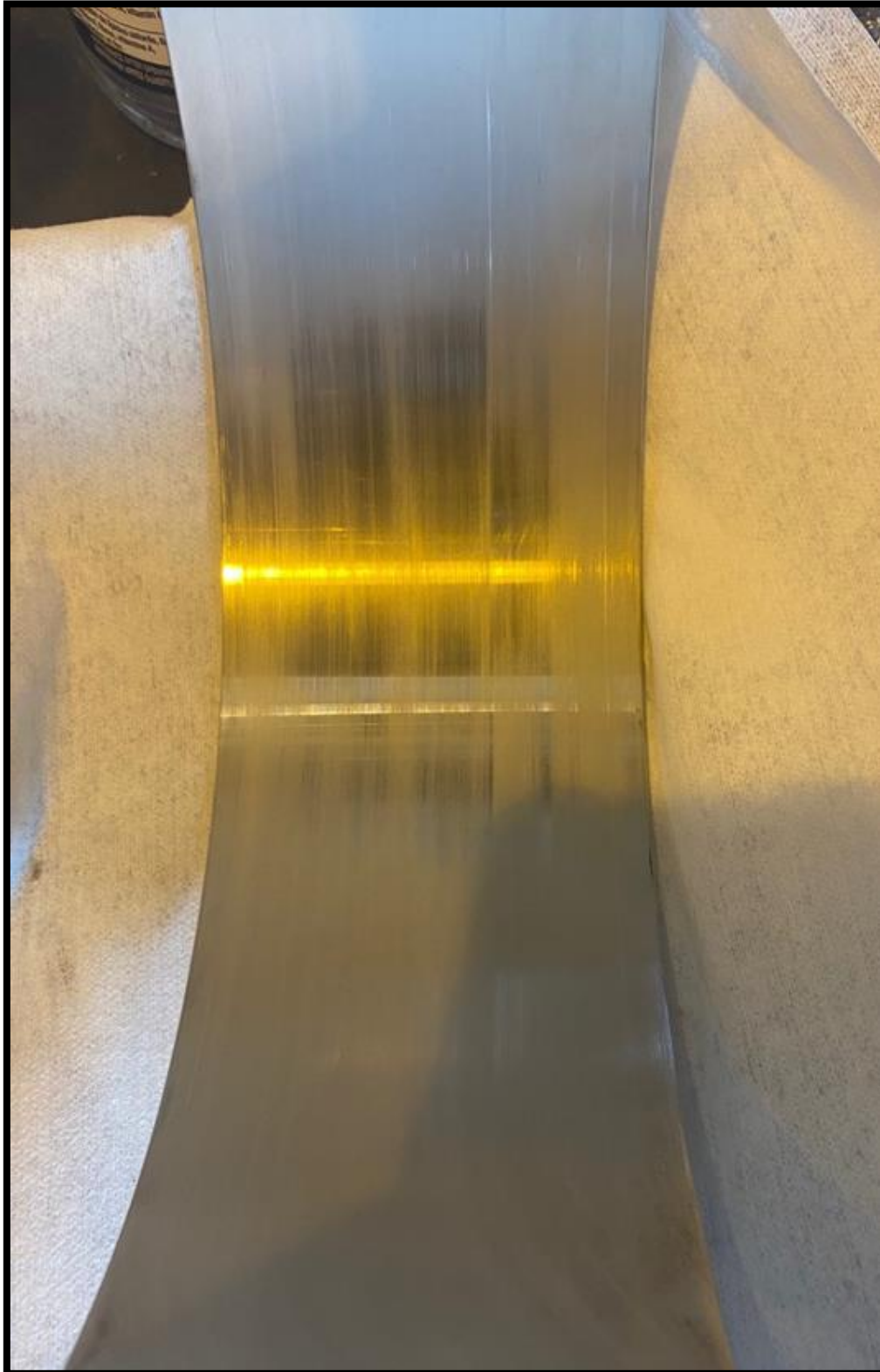


Figure 9- #4 Right - Rod Upper Cap Bearing



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**Wednesday Aug 24 – Dismantle and Inspect**

**Wednesday AM**

Clean and inspect cylinder head

Borescope cylinders - liners and valve in good condition, carbon build up was minimal.

Set and up tooling and removed #4 right cylinder liner

Inspected liner

- O-rings are in poor condition

Inspected block and liner fits #4 right

- cavitation noted on the lower liner fit - still in usable condition as O-ring sealing surface is still good



Figure 10- #4 Right Liner



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Wednesday AM



Figure 11 - #4 Right Deck Surface



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Wednesday AM



Figure 12- #4 Right Liner O-rings



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Wednesday AM

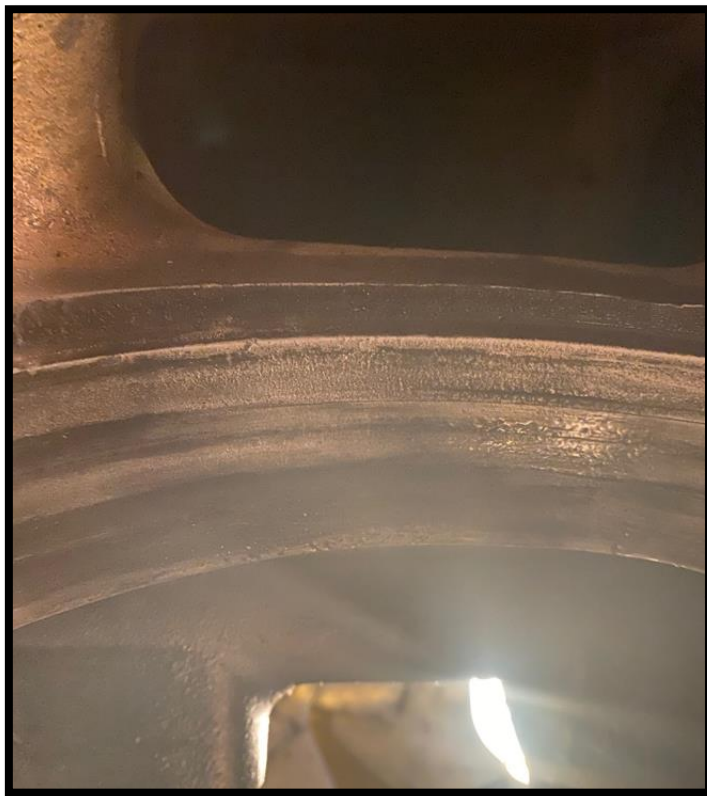


Figure 13- #4 Right - Lower Liner Fit



Figure 14- #4 Right - Lower Liner Fit



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Wednesday AM



*Figure 15- #4 Right Upper Liner Fit*



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## Wednesday PM

### #4 Main Bearing

- Removed main cap cross ties
- Set up hydraulic tooling and loosen off main cap nuts
- Lowered main cap and inspect
  - Bearing in good condition
  - Crankshaft in good condition
  - Cap surfaces - good condition with no fretting on mating surfaces
- Clean and apply Lubriplate to main bearing
- Install main bearing and cap
- Stretch studs and tighten main can nuts
  - 9000 PSI
- Install and torque cross tie bolts to 1400 ft lbs
- Measure crankshaft end play
  - Moved feely
  - 0.012"

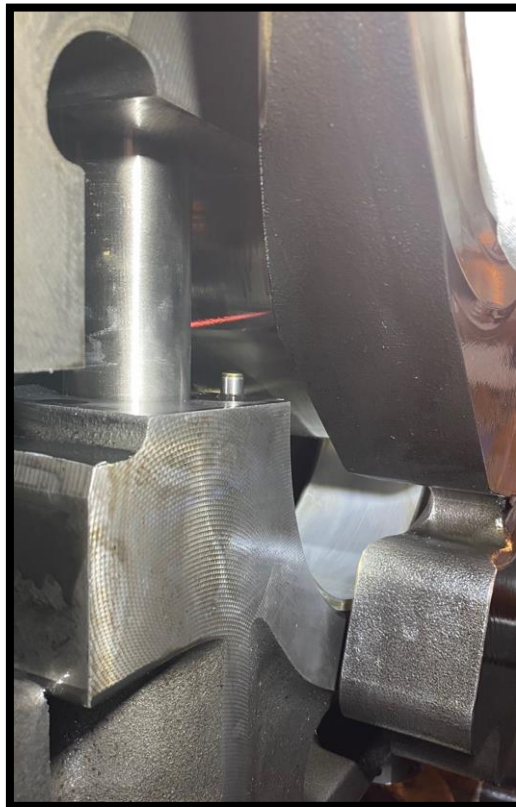


Figure 16- #4 Main Cap and Bearing



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**Wednesday PM**



*Figure 17- #4 Main Bearing*



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Wednesday PM



Figure 18- Crankshaft #4 Main Journal



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Wednesday PM

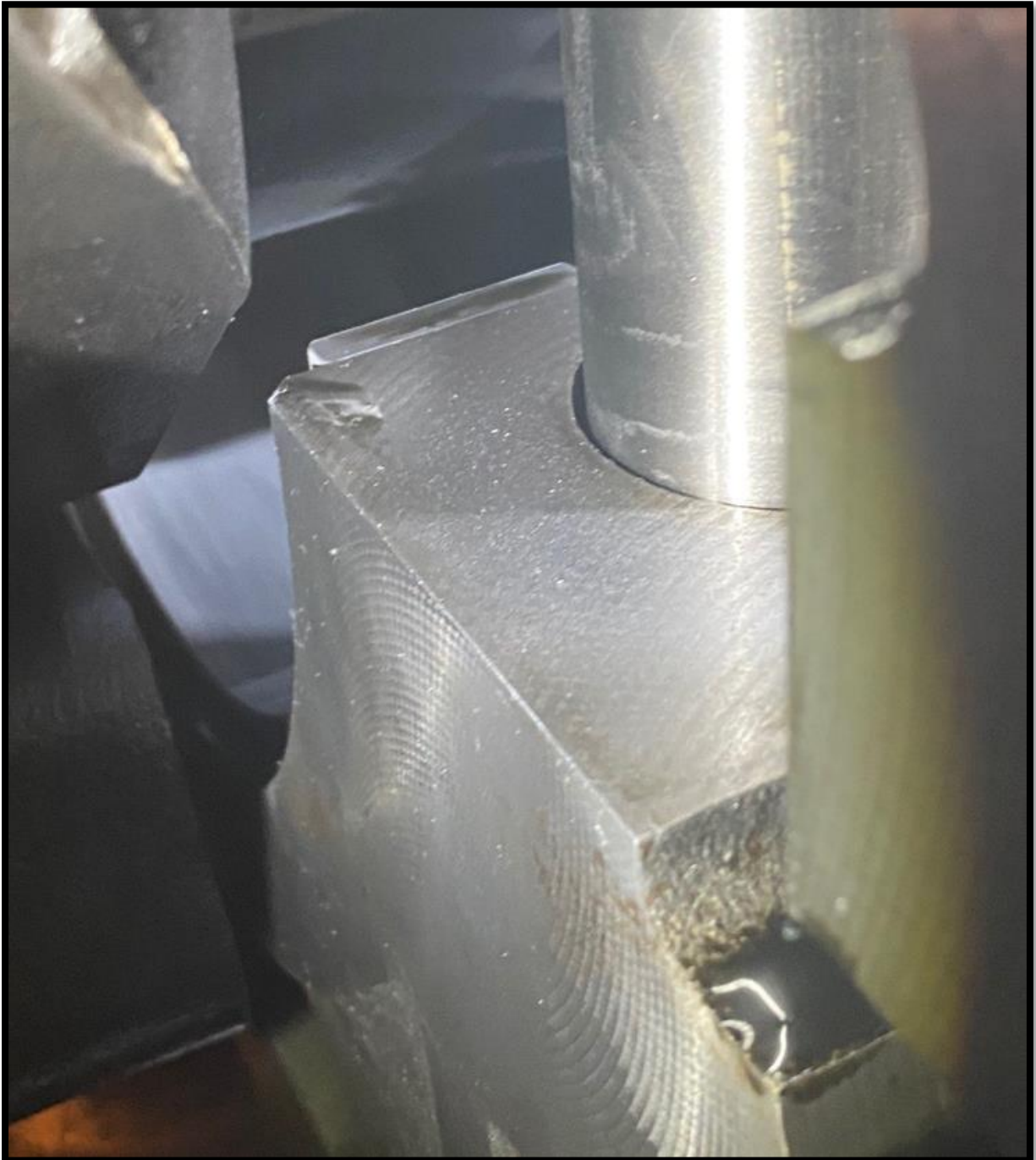


Figure 19- #4 Main Cap - Mating Surface



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Wednesday PM



Figure 20- Crankshaft endplay - 0.012"



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**Wednesday PM**

Clean and buff liner fits

- Good condition

Clean and inspect liner and O-ring grooves

- good condition
- Inspect and install new liner O-rings
- Lubricate O-rings and liner fits & install liner

Clean & Inspect piston and ring grooves

- good condition

Remove and inspect wrist pin and connecting rod bushing

- Minor scratching noted on bushing and wrist pin
- Measure pin to conrod fit - 0.0055"



*Figure 21 - #4 Right Connecting Rod Bushing*



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Wednesday PM



Figure 22 - #4 Right Wrist Pin

- Inspect and install new piston rings
- Remove crankshaft wrapping and inspect
- Install piston and conrod assembly
- Libriplate conrod main bearing
- Install and torque bearing cap
  - 220 ft lb plus 180°
- Clean and inspect cylinder head
  - good condition
- Clean and inspect block deck
  - good condition
- Inspect and install cylinder head O-ring and gaskets
- Clean and inspect head studs
  - good condition
- Install cylinder head and set up hydraulic tooling
  - Stretch studs at 5000 psi and tighten head bolts



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**Thursday Aug 25 - Dismantle and Inspect**

**Thursday AM**

Cylinder #4 right head

- Inspect and install new injector O-rings
- Install injector into cylinder head
  - Torque bolts to 35 ft lb
- Install rocker and bridge assemblies
  - Torque bolts to 175 ft lb
- Install intake and exhaust piping
  - With new exhaust piping gaskets

Cylinder #5 left

- Disconnected and removed coolant and exhaust piping
- Removed rocker and bridge assembly
- Removed injector and inspect
  - Good condition
- Set up hydraulic tooling and stretch head studs, back off head bolts
- Removed cylinder head and inspected
  - good condition
- Remove connecting rod bolts and cap
  - Inspect cap and bearings
    - Good condition
- Removed piston and conrod assembly
- Wrapped crankshaft to protect from contamination



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**Thursday AM**



*Figure 23- #5 Left Connecting Rod Upper Bearing*



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**Thursday PM**

Inspected #5 left piston

- Top piston ring seized in ring groove
- Minor chrome flaking from top piston ring



*Figure 24 - Piston #5 Left - Top ring seized and flaking*

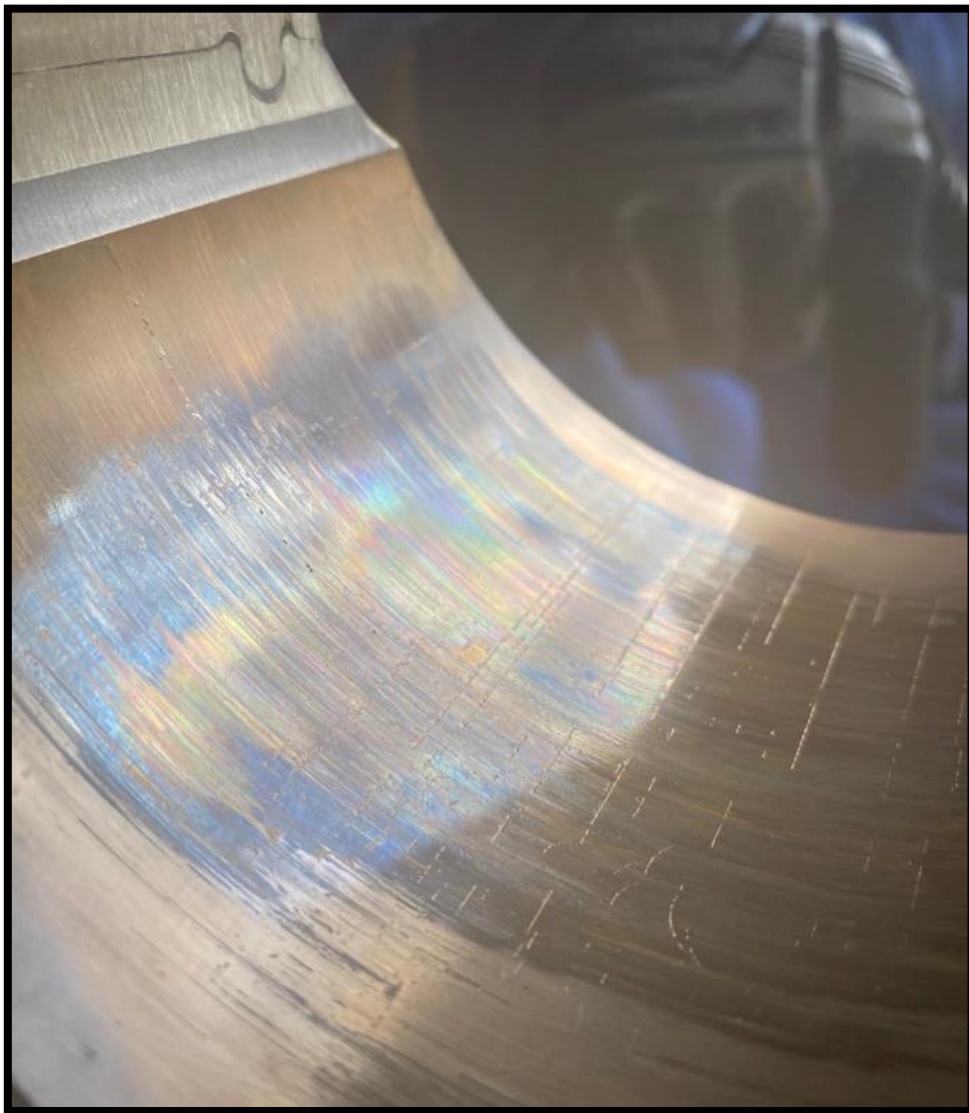


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**Thursday PM**

Removed wrist pin and inspected

- Rod bushing showed fractures
- Wrist pin showed minor scratching
- Measured clearance at 0.006”



*Figure 25 - #5 Left Rod Bushing*



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**Thursday PM**

Cleaned piston and inspect ring grooves

- Inspected new piston rings and instal

Removed liner and inspected

- Liner O-rings showed some scuffing but not as bad as #4 Right
- Cleaned liner
- Inspected and installed new O-rings



*Figure 26 - #5 Left Liner*



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**Thursday PM**

Inspected block liner fits

- Good condition minimal to no signs of pitting
- Cleaned and buffed liner fits
- Installed liner into block



*Figure 27 - #5 Left Upper Liner Fit*



*Figure 28 - #5 Left Lower Liner Fit*



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## **Thursday PM**

Lubriplates rod bearings

Installed piston and rod assembly

- Torqued rod cap - 220 ft lbs plus 180

#5 Left Cylinder Head

- Inspect and install new head O-rings and gaskets
- Inspect and clean head studs
- Installed cylinder head
- Set up hydraulic tooling and stretch studs at 5000 psi
- Tighten down head bolt nuts

Filled engine with coolant

Activated block heat circulation

## **Friday Aug 26 –Service and Function Testing**

### **Friday AM**

Inspected liners and crank case for any signs of coolant leaks - none

Cylinder #5 left head

- Inspect and install new injector O-rings
- Install injector into cylinder head
  - Torque bolts to 35 ft lb
- Install rocker and bridge assemblies
  - Torque bolts to 175 ft lb
- Install intake and exhaust piping
  - With new exhaust piping gaskets

Replaced oil filters and filled engine with oil

Complete valve lash settings on all cylinders

- Exhaust 0.039
- Intake 0.024

Complete injector settings on all cylinders

- 118.0 mm

Check and adjust injector rack

Spinner filters were cleaned and installed - very dirty and contaminated

Inspect air filters good condition



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- Install all crank case doors

### Friday PM

Install and torque valve covers

Inspect and function test rig saver valve

- Successful test

Alternator

- Visual Inspect windings
  - Could use a cleaning
- Visual Inspect coupling
  - good condition

Verified all fluid levels

Pre-lube engine and prep for start up

Start engine and monitor at idle

- Load engine and monitor 2 hrs full load
  - 25%, 50%, 75%, and 100% load steps
- Idle engine and cool down

Items noted during running:

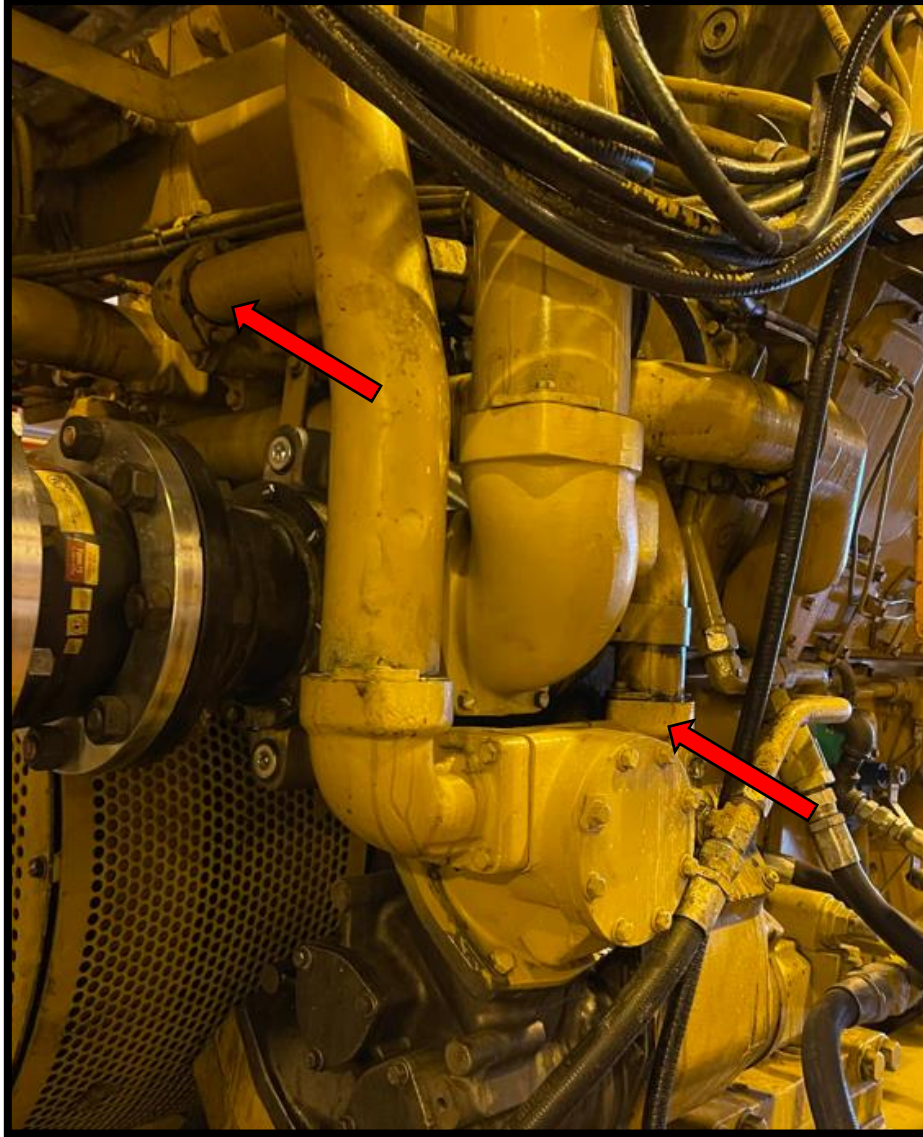
- Oil pump piping leaking
- #5 Cylinder continues to run hotter





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**Friday PM**



*Figure 29 - Oil pump leaking pipes*

Shut down and clean up tooling

**Saturday Aug 28**

- Clean site and pack up tooling
- Inspect unit and verify no leaks
- Verify fluid levels
- Complete job reports



## Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

- Depart to Whitehorse

### **Sunday Aug 29**

Meet with customer rep in Whitehorse and review high level findings  
Travel from Whitehorse Yukon to Red Deer Alberta

### **Monday Aug 30**

Gather onsite notes and complete reports

### **Conclusion and Recommendations**

#### **Conclusion:**

After inspecting and testing the engine we conclude that it is in good shape. The major components appear to be in favorable condition to continue running and rebuilding when required.

There are a few items to address in the near future and some items to monitor moving forward. Once the high-level items are addressed, we recommend continued use of the engine until future conditional testing shows signs of issue or 40,000 hr. marker is reached.

Based on the condition of the engine block and crank the hour meter showing 28,000 hrs. seems to be within a reasonable range of accuracy.

#### **Immediate Recommendations:**

- Replace front outer vibration dampener, recommend replacing both at this time
- Replace #3 right injector
- Install vibration altimeter devices – 2 on engine and 2 on alternator
- *Verify fuel sulfur content and appropriate oil based on sulfur levels*

#### **Medium Level Recommendations:**

- Repeat conditional monitoring testing every 2,000 to 3,000 operating hrs or two years
  - Use the current report as a base line
- 1,000 hr or annual oil sample analysis
- *Replace remaining injector O-Rings at a routine maintenance interval*

#### **Low Level Recommendations:**

- Budget and plan for an in frame onsite overhaul in approx. 12,000 operating hours
  - Heads
  - Turbos
  - Pistons
  - Liners
  - Connecting rod bushings
  - Cam bushings
  - Rod and main bearings



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Update 9/22/2021 – Questions presented by Yukon Energy representative:

**Figure 1 – Injectors with sheared O-ring**

- **Q:** *Is this because of improper installation?*
  - **A:** *Yes, this is an issue with the previous installation of the injectors, the O-ring were damaged / pinched upon installation.*
- **Q:** *Is there reason to suspect other injectors may have the same problem?*
  - **A:** *A visual inspection of all injectors was completed and is how the two sheared O-rings were discovered. It is possible that others are damaged, and the damage is not visible.*
- **Q:** *What's the risk if there are?*
  - **A:** *The risk of these O-rings being damaged or failing, is the potential of diesel fuel leaking past the O-ring and pushing into the oil system. This would dilute the oil causing it to lose its lubrication properties.*
- **Q:** *Should we inspect the other injectors, or only if indicator makes itself known?*
  - **A:** *A visual inspection of all the injectors was completed while onsite. The two damaged O-rings were replaced with new and updated O-rings. As a precautionary measure, the remaining injector O-rings can be replaced with the updated O-rings. This could be planned at a scheduled repair or service interval. \*\*Added to Medium Level Recommendations list above.*
- **Q:** *What should we monitor?*
  - **A:** *Monitoring for this potential risk is through routine oil sample analysis. Fuel levels in the oil would be an indicator to watch for.*

**Figure 3 – Front Dampener Oil**

- **Q:** *The oil is obviously contaminated. Should we change the oil, or is the oil in this condition because the dampener is failed?*
  - **A:** *The oil is contaminated with wear metals, most commonly from internal wear rings. This would require major cleaning, new internal components, as well as fluids. This is not a field serviceable item, we recommend replacing with a rebuild dampener.*

**Figure 5 – #4 Right Injector Bore**

- **Q:** *There is an arrow pointing to the wear, but help us understand – is this serious?*
  - **A:** *It is not serious and just something we took note of.*
- **Q:** *What should we do about it?*
  - **A:** *There are no recommended actions at this time, this would be corrected when the head is reconditioned.*



## Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

### **Figure 7 & 8 – #4 Right Piston Carbon Flaking, also Figure 24.**

- **Q:** *Are these conditions normal? Excessive? Minor? What's the impact? Need interpretation.*
  - **A:** *This is not a normal condition but also not excessive, this is most likely caused by higher sulfur levels in the diesel fuel. See figure 30 below.*
- **Q:** *Should we do anything?*
  - **A:** *While onsite the two removed piston, were cleaned and new piston rings were installed. Additional items to do:*
    - *Identify your diesel fuel sulfur levels and verify the proper oil is being utilized to match the sulfur levels. See figure 31*
      - *\*\*Added to Immediate Level Recommendations list above.*
    - *Routine oil analysis, monitor for elevated chrome levels and oil degradation.*
    - *Operational observations:*
      - *Excessive blow by: if the piston rings stick or fail, the engine will experience blow by of combustion gasses into the crank case. This will be observed with exhaust gasses in the crankcase, elevated crankcase pressure, and performance losses.*
      - *Elevated oil consumption: Monitoring oil consumption can identify piston rings failure, allowing excessive oil to enter the combustion chamber and out the exhaust system. This can also make the exhaust turn a bluish color.*
- **Q:** *Given the current condition will these run for another 12,000 hours? Or should we plan on addressing ahead of time?*
  - **A:** *Continue to operate the equipment and monitoring. We estimate it will run for another 12,000 hrs.*
- **Q:** *How long do you think these will last? Is it likely we'll need to intervene in the medium term?*
  - **A:** *Without knowing more of the engines history and trending the issues an accurate prediction is difficult to make. We are suggesting operating the unit and monitoring as noted above. Our estimation based on our observations are the this will not be a medium-term item.*
- **Q:** *What does this tell us?*
  - **A:** *That the diesel fuel may contain higher sulfur levels, and the oil should be evaluated accordingly.*

### **Figure 10 & 12 – #4 Right Liner.**

- **Q:** *The O-ring looks damaged. How long is something like this expected to last?*



### Yukon Energy – Faro - FD7 – Cat 3612 SN: 9RC00071

- *A: Even though the O-ring appears damaged, some or most of that damage likely occurred upon removal of the liner from the block.*
- *Q: What is the risk?*
  - *A: If the O-ring failed, coolant would enter the oil system. This would dilute the oil causing it to lose its lubrication properties.*
- *Q: What should we look at doing because of this condition?*
  - *A: New O-rings were installed onto the two removed liners identified. We recommend continuing to operate and monitor with routine oil analysis for traces coolant in the oil.*

### Page 16 Crankshaft Endplay.

- *Q: Should this be measured with the crankshaft positioned at the four different quadrants. Comments?*
  - *A: Endplay measures the axial movement of the crankshaft. It is not normal to measure this in four different quadrants. Perhaps this is being compared to a “Crankshaft deflection measurement”?*
- *Q: Is 0.012” acceptable? What is the go/no go tolerance?*
  - *A: Yes this is acceptable, manufacturer tolerance is 0.008” to 0.024” of axial end play.*

### Figure 25. Rod Bushing

- *Q: There is a note that the rod bushing shows fractures, but there is no interpretation. Are the fractures a cause for concern?*
  - *A: It is possible this was caused by detonation in the combustion chamber, potentially a bad injector in the past. The bushing and wrist pin were within fit tolerances. There was no identification of abnormal operations during the condition monitoring. Based on the conditional monitoring, clearances, and visual inspection we feel this should not have an issue achieving another 12,000 hours.*
- *Q: Is this normal, or is there an action we should take? Prognosis?*
  - *A: As recommended above, install vibration altimeter devices and continue to operate. Routine oil analysis to confirm sufficient lubrication to the bushing, and routine conditional monitoring to trend operational conditions.*
- *Q: Appears to show discolored bushing surface. Is this normal?*
  - *A: This is not uncommon and could be another symptom of sulfur in fuel, causing acid in the oil. As recommended above, install vibration altimeter devices, and continue to operate. Routine oil analysis to confirm sufficient lubrication properties, and routine conditional monitoring to trend operational conditions.*



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**Additional Items:**

**Q: Provide a budgetary forecast value of an on-site overhaul at 40,000 hours, all-in price.**

*A: This is in the progress of being quoted.*

**Q: Provide a budgetary forecast value of a replacement like-for-like engine, utilizing onsite auxiliary equipment.**

*A: This is in the progress of being quoted.*

**Q: Are any assemblies or subassemblies on this engine as obsolete or flagged for replacement by a CAT service bulletin?**

*A: Yes, there are going to be quite a few, we will build this into the above quote costing. As we replace items we update when applicable.*

**Q: Do any of the noted items in the report look like they will lead to bigger issues before 40,000 hours? Is there a medium time frame forecast or recommendation that can be validated as we proceed with 2,000 hour service/inspection intervals?**

*A: Completing all the “Immediate Recommendations” listed above, along with the “Medium Level Recommendations” (Monitoring items) will provide a layer of protection and trending in the engine. As oil analysis and conditional monitoring continues, trending the data will provide more clarity and improve timeline estimations. We expect based on our observations that this unit should achieve 40,000 operating hours without forecasting a medium time frame of repairs.*

**Cause: Sulfur**

**Effect:** The presence of sulfur signals danger to all engine parts. The type of corrosive wear attributed to high sulfur content can also cause accelerated oil consumption. Also, the more fuel consumed during an oil change interval the more sulfur oxides are available to form acids. Therefore, the TBN in engines working under heavy loads should be checked more often. Fuel sulfur damage can cause piston ring sticking, and corrosive wear of the metal surfaces of valve guides, piston rings and liners.

Figure 30 – CAT note on Sulfur damage



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## **TBN for Distillate Fuel Engines**

The TBN recommendation for an oil depends on the sulfur level of the fuel used. For 3600 diesel engines running on distillate diesel fuel, the minimum new oil TBN (by ASTM D2896) should be ten times the fuel sulfur level, and the minimum TBN is five regardless of sulfur level. In areas where the fuel sulfur exceeds 1.5 percent, choose an oil with the highest TBN that meets the Caterpillar performance requirements, and shorten the oil change interval based on oil analysis. The Scheduled Oil Sampling (S•O•S) analysis program should evaluate oil condition and wear metals. High TBN oils that do not meet the recommended performance requirements can produce excessive piston deposits, leading to a loss of oil control and bore polishing.

*Figure 31 – TBN for Distillate Fuel Engines*

## **YEC 2023/24 GRA**

**Exhibit #\_\_\_\_\_**

### **Undertaking #21**

- March 6, 2024 Transcript, page 312, lines 22-24: To advise how you go about changing the nameplate capacity of a unit.

### **YEC Response:**

This question is based on a mistaken assumption.

As explained in response to Undertaking #43, the correct nameplate capacity of DD1 is in fact 800 kW, as indicated in NY-YEC-1-2 REVISED Attachment 1 (Exhibit 4, PDF page 4), and has not changed.

On review, YEC has verified that Mr. Murchison's statements in the March 7, 2024 Transcript (pages 461 and 574-575) that the nameplate capacity of DD1 was 1,000 kW were mistaken, and should be corrected as noted above.

The response to NY-YEC-1-2(a) REVISED (Exhibit 4, PDF pages 2-3) also explained that the different nameplate capacity specified for DD3 in NY-YEC-1-2 REVISED Attachment 1 [1,030 kW] compared with what was previously stated in Exhibit 2, on PDF page 21 [1,000 kW] was merely a correction. The correct nameplate capacity for DD3 is 1,030 kW, and has not in fact changed.

## YEC 2023/24 GRA

Exhibit # \_\_\_\_\_

### Undertaking #22

- March 6, 2024 Transcript, page 342, lines 9-16: To update Table 3.4 to include two additional columns for actual 2023 and year-to-date 2024 to show the separate vacancies spoken of earlier and basically where YEC is in order to have a clear Table 3.4 rather than just proposed 2023 and proposed 2024.

### YEC Response:

Please see an extended version of Table 3.4 as requested.

The vacancy rate for 2023 was 12.21 as compared to the GRA forecast of 9.00. As there were more vacant positions than budgeted, YEC incurred more overtime hours than forecast in the GRA. Actual overtime hours for 2023 were 1,240 hours as compared to a GRA forecast of 866 hours. The cost savings in vacant positions were offset by higher overtime costs [the actual labour costs for 2023 was \$18.966 million as compared to a GRA forecast of \$18.489 million].

**Table 3.4: Employee Complement History**

	Approved 2021	Actual 2021	Actual 2022	Proposed 2023	Proposed 2024	2023 Actuals	2024 Actuals as of March 6, 2024
President & Corporate Services	4.16	4.07	3.20	3.10	3.10	3.34	3.33
Government Relations	1.00	1.00	1.00	1.17	2.00	1.00	2.00
Business Development			1.00	1.00	1.00	1.00	1.00
Communications & Customer Service	3.60	3.60	3.60	4.43	3.60	4.60	4.15
People & Culture	1.00	1.00	1.00	2.00	2.00	2.00	2.00
Resource Planning, Environment, Health & Safety	8.05	8.04	9.80	10.60	11.13	11.10	11.90
Finance, Procurement & IT	19.04	19.10	20.13	19.29	20.29	19.41	20.83
Operations	48.25	49.89	50.74	51.96	53.20	51.45	54.08
Engineering Services	15.50	15.16	16.56	20.50	23.50	19.75	23.25
<b>Total</b>	<b>100.60</b>	<b>101.86</b>	<b>107.03</b>	<b>114.05</b>	<b>119.81</b>	<b>113.65</b>	<b>122.54</b>
Vacant	8.00	8.99	12.62	9.00	9.00	12.21	5.25
Filled	92.60	92.87	94.41	105.05	110.81	101.44	117.29

Note:

1. The employee complement numbers are net of allocation to YDC.
2. The employee complement for Engineering Services for 2024 actuals is lower than forecast by 0.25 due to the transfer to Resource Planning.

**YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**


**Undertaking #27**

- March 6, 2024 Transcript, page 370, lines 19-21: To resubmit the capitalization policy regarding property, plant, and equipment.

**YEC Response:**

A copy of the Property, Plant and Equipment Accounting Practice filed previously during the 2021 GRA is attached as Attachment 1 to this undertaking response.

Since the accounting practice refers to FX-004 AFUDC (AFUDC Accounting Practice), a copy of FX-004 AFUDC is also attached as Attachment 2 to this response.

	<b>Finance</b> <b>Accounting Practice</b> <b>FX-Appendix</b>	<b>DEPARTMENT:</b>		<b>INQUIRIES TO:</b>		<b>TOPIC:</b>	
		All		Finance		Property, Plant and Equipment Definitions	
		<b>ISSUED:</b>		<b>REVIEW DATE:</b>		<b>APPROVED BY:</b>	
		January 1, 2021		January 1, 2024		Chief Financial Officer	

## 1.0 Purpose

To provide detailed definitions for various Property, Plant and Equipment (PP&E) terminologies.


## 2.0 Definitions

1. ***Property, plant and equipment*** are identifiable tangible assets that meet all of the following criteria:
  - a) are held for use in the production or supply of electrical services, for administrative purposes, or for the development, construction, maintenance or repair of other property, plant and equipment;
  - b) have been acquired, constructed or developed with the intention of being used on a continuing basis for longer than one year;
  - c) are not intended for sale in the ordinary course of business (i.e. goods purchased for resale),
  - d) have a cost greater than \$1,000.
  
2. ***Acquisition Costs***
  - a) The cost of an item of property, plant and equipment includes the purchase price and other acquisition costs such as options costs when an option is exercised, brokers' commissions, installation costs, site preparation costs, freight, brokerage and duty charges, transportation insurance costs, , acceptance and commissioning costs.
  - b) The cost of an item of property, plant and equipment that is acquired, constructed, or developed over time includes carrying costs directly attributable to the acquisition, construction, or development activity such as interest costs. For a rate-regulated asset, the cost includes the directly attributable AFUDC allowed by the Yukon Utilities Board (YUB) (see 10.)
  
3. ***Units of Property*** represent the main units of equipment or property contained within each PP&E category. A unit of property is defined as that which is independently operational, readily separable and useful in its own right. Examples include dam, turbine, wood pole structures, conductors, transformers, regulators, circuit breakers, diesel engines and hydro generators.  
(refer to *GP Users Manual for Property, Plant and Equipment for additional information*)

4. **Components of Units** represent the associated parts or items making up units of property. Components must be in service to be considered for capitalization. Examples include transformer bushings, voltage regulator bushings, fuel pumps, cross arms, guys or insulators.
5. **Betterment** is an upgrade and/or enhancement that extends the life of a capital asset or increases its functionality or service potential without replacement of a complete unit. Betterment relates to such additions to the asset that increase its useful life, results in reliability and/or quality improvements, increase in previously assessed physical output or service capacity, reduces operating costs by a substantial and quantifiable amount over a period of at least three years or reduces financial liability, environmental or safety risks. Overhaul and maintenance of machinery and equipment are not betterment expenditures.
6. **Maintenance costs** incurred to maintain the service potential of an item of property, plant or equipment are repairs and must be expensed.  
  
*Note:* If a cost has the attributes of both a repair and betterment, the portion considered a betterment should be capitalized.
7. **Overhauls** are routinely conducted on diesel, wind and hydro production units. Major overhauls extend the useful life of the unit and minor overhauls maintain the efficient and effective operations of the unit. Costs associated with major overhauls are capitalized and depreciated, while costs associated with minor overhauls are expensed in the period in which they are incurred. (refer to FX-002 Overhauls for additional information)
8. **Allowance for Funds Used During Construction (AFUDC)** is imputed interest that is applied to capital projects during construction. It is intended to cover the cost of financing a capital project during the period of construction. AFUDC ceases when an item of property, plant and equipment is substantially complete and ready for productive use. Determining when an asset, or a portion thereof, is substantially complete and ready for productive use requires consideration of the circumstances and operating functions.  
*(refer to FX-004 AFUDC for additional information)*
9. **Asset retirements** – when assets reach the end of their useful life they are retired from service.
10. **Salvage** - is any recovery associated with the retirement of an asset from service including any proceeds received from the sale of the retired asset.

**11. *Net Salvage*** – is proceeds received from salvage less any costs incurred to remove or dismantle assets retired from service.

**12. *Disposals*** – assets are said to be disposed of when they are sold, destroyed, lost, abandoned, or expropriated. Disposals require the approval of the Chief Financial Officer.

	<b>Finance</b> <b>Accounting Practice</b> <b>FX-004</b>	<b>DEPARTMENT:</b>		<b>INQUIRIES TO:</b>		<b>TOPIC:</b>	
		All		Finance		AFUDC	
		<b>ISSUED:</b>		<b>REVIEW DATE:</b>		<b>APPROVED BY:</b>	
						_____ Chief Financial Officer	

**1.0 Issue**

The corporation earns a return on rate base which includes fixed assets in service. The Corporation does not earn a return on work in progress (WIP) or plant held for future use. In order to maintain the financial integrity and return earned the Yukon Utilities Board (YUB) allows the corporation to recognize an Allowance for Funds Used During Construction (AFUDC).

**2.0 Definition of AFUDC**

AFUDC is imputed interest that is applied to capital projects (including studies, water licensing and dam safety projects) during construction. It is intended to cover the cost of financing capital projects during construction, which result in additions to property, plant and equipment and deferred accounts. AFUDC ceases when an item of property, plant and equipment or dam safety project is substantially complete and in service, or a water license is obtained.

**3.0 Determination of Substantially Complete and In Service**

A fixed asset is deemed to be substantially complete and in service when the resulting asset, or portion thereof, is being used in the operation of the corporation. Determining if an asset, or a portion thereof, is substantially complete and in service may require consideration of the circumstances and the function in which it will be operated.

**4.0 Calculating the AFUDC Rate**

The rate used to determine the AFUDC charge to projects is calculated using the Weighted Average Cost of Debt (WACD). The most recent Board Order approving the current WACD approach is contained in Board Order 2013-01; issued March 25, 2013.

**5.0 Converting the Annual AFUDC Effective Rate to a Nominal Monthly Rate**

The annual effective AFUDC rate is converted to a nominal monthly rate as follows:

5.1 Using the excel formula =Nominal (Effective Rate, 12 compounding periods) convert the Annual AFUDC Effective Rate into a nominal rate. For example, assume the Annual AFUDC Effective Rate = 4.24%.

$$\text{Nominal Annual AFUDC Rate} = \text{NOMINAL}(4.24\%, 12) = 4.16\%$$

5.2 Divide the nominal annual AFUDC rate by 12 compounding periods to obtain the monthly nominal rate.

$$\text{Nominal Monthly AFUDC Rate} = \text{Nominal Annual AFUDC rate divided by 12 months} = 0.3464\%$$

## 6.0 Applying AFUDC to Capital Jobs

AFUDC is applied to the average monthly balance of open capital jobs, net of contributions and excluding any previous AFUDC applied to the job.

6.1 Opening balance = Costs of project at the beginning of the month – Contributions to project at the beginning of the month - AFUDC previously applied to Job

6.2 Ending balance = Costs of project at the end of the month – Contributions to project at the end of the month - AFUDC previously applied to Job

6.3 Average balance = (Opening balance + Ending balance)/2

If the Average balance is negative, no AFUDC will be applied to that Job.

6.4 AFUDC applied to Job = Average balance \* Nominal Monthly AFUDC Rate

## 7.0 Journal Entry to Record AFUDC Income

**Debit** WIP (Balance Sheet Account)

Job #

Cost Code: Cap/AFUDC (999-8700)

**Credit** AFUDC Income (Income Statement Account)

9093-958-4985

## **YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

### **Undertaking #28**

- March 6, 2024 Transcript, page 384, lines 23-25: To provide an estimate or listing and the year for the study costs that have been expensed.

### **YEC Response:**

Section 2.1 of the Planning Cost Accounting Policy approved by the YUB states the following:

2.1 The following planning and study costs will be recorded as an expense of the period in which they are incurred:

- a. Planning and study costs which are pure research in nature. It should be noted that costs of this type, if any, are not expected to be significant.
- b. Planning and study costs related to ongoing operations, unless it can be demonstrated that these costs provide long-term or multi-year benefits to the system.

In accordance with this policy, the estimated study costs expensed in 2023 are approximately \$80,000, which includes studies for renewable energy projects engineered for Canada's remote and northern communities [approximately \$50,000], DEIB studies [approximately \$50,000] and electrical engineering studies [approximately \$10,000]. YEC considers this 2023 amount to be a reasonable estimate for the amount of study costs expensed in other years.

**YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

**Undertaking #29**

- March 6, 2024 Transcript, page 386, lines 3 – 6: To provide a list of projects less than \$100,000 that are included at Table 5.6 in the Application.

**YEC Response:**

Please see the requested table.

**Table 1. Deferred Costs – Projects \$100,000 to \$1 million - Rate Base Additions  
Other Projects with <\$100k Spending [\$000]**

	2021	2022	2023	2024	Notes
PMF Flood Study	77.8				Potential to add new assets to the system based on study results
FD7 Generator Condition Assessment	73.3				Potential to add new assets to the system based on assessment results
Trash Rack Cleaning Study	59.2				Potential to add new assets to the system based on study results
Wareham Spillgate Leakage Reduction Study	52.5				Potential to add new assets to the system based on study results
Emergency Preparedness Improvement		59.5			Potential to add new assets to the system based on study results
WH4 Low Tailwater Cavitation Study		46.8			Potential to add new assets to the system based on study results
P126 Building Assessment		46.2			Potential to add new assets to the system based on assessment results
WH4 Turbine Floor Cooling Upgrade Assessment		19.6			Potential to add new assets to the system based on assessment results
Aishihik Elevator Shaft Moisture Reduction Assessment		0.5			Potential to add new assets to the system based on assessment results
Mayo Lake CS./Wareham Dam Seismic Assessment			75.0		Potential to add new assets to the system based on assessment results
SDIC Program Development			60.0		Potential to add new assets to the system based on study results
Mayo Lake/Wareham Dam Breach Study			59.0		Potential to add new assets to the system based on study results
IPP System Study			50.0		Potential to add new assets to the system based on study results
SCADA/Server Room Fire Assessment			40.0		Potential to add new assets to the system based on assessment results
Wareham Dam Toe Seepage Analysis			35.0		Potential to add new assets to the system based on assessment results
2021 GRA (Hearing Reserve Acct)			23.1		Charged to Hearing Reserve [see Schedule 3B-2023, Tab 7]
IPP System Study				50.0	Potential to add new assets to the system based on study results
Substation Ground Grid Plan/Study				50.0	Potential to add new assets to the system based on study results
Pressure Vessel Certification Program				50.0	Potential to add new assets to the system based on study results
Climate Change Adaptation				40.0	Potential to add new assets to the system based on study results
Transmission Line Corridor Heritage Overview Assessment				30.0	Potential to add new assets to the system based on assessment results
Miscellaneous Adjustment				-230.0	Adjustment to reduce the overall deferred costs
<b>Total</b>	<b>262.8</b>	<b>172.6</b>	<b>342.2</b>	<b>-10.0</b>	

**Note:**

1. -\$0.230 million for 2024 was included to reduce overall cost of deferred costs.

## **YEC 2023/24 GRA**

**Exhibit #\_\_\_\_\_**

### **Undertaking #30**

- March 6, 2024 Transcript, page 438, lines 19-23: To provide an Excel workbook showing the calculation of each of the years of the AFUDC amount shown in Exhibit 2, the response to UCG-YEC-1-31 at pdf page 197.

### **YEC Response:**

An Excel file calculating the AFUDC charged to the Southern Lakes Project as shown in UCG-YEC-1-31(h), Exhibit 2, PDF page 197, is attached as Attachment 1 to this undertaking response.

Please note that AFUDC is a monthly system-generated calculation that is not performed in Excel. Accordingly, for purposes of providing an Excel file consistent with the AFUDC shown in UCG-YEC-1-31(h), the attached Excel file uses approximate average non-AFUDC project costs for each year to calculate the total AFUDC. The AFUDC rates in the Excel file are the annual rates used by YEC in the actual calculations, except for the column 'Cumulative to 2012' where YEC does not have data for the rates used for the years 2009-2012.

Under the IFRS, only debt is allowed to be charged for AFUDC.

**YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

**Undertaking #31**

- March 6, 2024 Transcript, page 440, lines 11-19: With reference to Exhibit 2 at pdf pages 193 and 194, a UCG IR [UCG-YEC-1-31(a)], and the table that was provided, to break out which year of costs in that table have been allocated to either the 3-year, the 5-year, or the 25-year licence renewals, or any other licence renewals, and to provide same.

**YEC Response:**

The following table shows the annual costs incurred by YEC for the Aishihik Generating Station relicensing since 2015, and identifies, for each year, how those costs have been allocated to the 3-year, 5-year, and 25-year license renewals. In that regard, please note the following:

- As indicated previously in Appendix 5.2A of YEC’s Application, Section 5.2A, footnote 2 (Exhibit 1, PDF page 232), a material portion of costs incurred to date related to impact assessment, monitoring, stakeholder engagement and consultation and other costs incurred from 2015 to 2018 are considered foundational costs incurred to support the 25-year license renewal. However, YEC did not have separate projects for the 3-year, 5-year and 25-year renewals until 2019, when the costs were separated into the 3-year renewal and long-term term renewal costs, and 2022 when the long-term renewal costs were further separated into 5-year and 25-year renewal costs.
- The response to UCG-YEC-1-31 (a) (Exhibit 2, PDF page 194) provided the actual costs to 2022 (subject to the correction identified in Note 1 to the table below) and preliminary actuals for 10 months of 2023 based on costs at the time that IR response was prepared. The table below has been updated to provide the 2023 actuals for the full year.

	Annual Expenditures	Cumulative	3-Year License	Longer Term Cumulative	5-Year License	25-Year License
	A	B	C	D=B-C	E	F=D-E
\$000						
2015	50	50		50		
2016	955	1,005		1,005		
2017	1,969	2,974		2,974		
2018	1,983	4,957		4,957		
2019	1,317	6,275	805	5,470		Note 1
2020	2,270	8,544	112	7,627		
2021	1,273	9,817		8,900		
2022	1,313	11,131		10,214	4,479	5,735 Note 2
2023					40	811 Note 3
2024 F					189	1,428 Note 3
<b>Total</b>			<b>917</b>		<b>4,708</b>	<b>7,974</b> Note 4

Notes:

1. The table provided in response to UCG-YEC-1-31(a) (Exhibit 2, PDF page 194) by error excluded \$0.805 million in expenditures closed in 2019 for the 3-year licence renewal. The total expenditures for 2019 should have been \$1.317 million, not \$0.513 million. The total costs allocated to the 3-year renewal were \$0.917 million as noted in response to YUB-YEC-1-61(e) (Exhibit 2, page 484), which included \$0.805 million closed in 2019 and \$0.112 million closed in 2020.
2. In 2022, \$5.735 million of the long-term renewal costs incurred from 2015 to 2022 were allocated to the 25-year renewal as explained in a note to Table 5.3 of the Application (Exhibit 1, PDF page 144) and in response to YUB-YEC-1-61(b) and (c) (Exhibit 2, PDF page 483).
3. In response to YUB-YEC-1-61(f) (Exhibit 2, PDF page 484), YEC previously noted that the total forecast costs for the 5-year renewal were \$5.521 million. This reflected an increase of about \$1.042 million over the forecast included in the Tab 5 tables of the GRA, as that forecast did not fully reflect costs for community and individual compensation, as well as the costs of securing a Fisheries Act Authorization (which has been extended into late 2024 due to the time necessary for the FAA renewal process to be completed). However, Mr. Epp corrected this during the oral hearing (March 6, 2024 Transcript, page 344, lines 8-23), stating that out of \$1.042 million, about \$0.230 million was related to the 5-year renewal and the remaining was related to the 25-year renewal. The above table now reflects these incremental costs.
  - Total cost for the 5-year renewal in the Application was \$4.479 million [Table 5.6 of the Application] plus about \$0.230 million additional cost [\$0.040 million in 2023 and \$0.189 million in 2024] for a total cost of \$4.708 million. Out of a total of \$4.708 million, \$3.903 million closed in 2022 as shown in Table 5.6 of the Application and the remaining \$0.805 million is to be closed in 2024.
  - The cost for the 25-year renewal in the application to the end of 2024 was \$7.160 million [Table 5.7 of the Application] plus \$0.814 million in additional costs, for a total cost of \$7.974 million by the end of 2024. These costs remain in WIP and do not impact revenue requirements for the 2023 and 2024 test years.
4. The costs are forecast costs to 2024 and not total costs as the table does not include forecast costs beyond 2024.

**YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

**Undertakings #32**

- March 6, 2024 Transcript, page 441, lines 14-20: With reference to Exhibit 2 at PDF pages 193 and 194, a UCG IR [UCG-YEC-1-31(a)], and the table that was provided, to advise of how much AFUDC is included for each year for each of those actual and forecast licence renewal costs.

**YEC Response:**

The following table shows the annual and cumulative AFUDC amounts included in the Aishihik GS relicensing costs, and the allocation of total AFUDC between the 3-year, 5-year and 25-year renewals.

\$000	Annual AFUDC	Cumulative AFUDC
	A	B
2015	0	0
2016	6	6
2017	33	39
2018	79	118
2019	136	254
2020	167	421
2021	200	621
2022	213	834
2023	184	1,018
2024 F	211	1,229
Total AFUDC by end of 2024		1,229
3-year License		2
5-year License		493
25-year License		734

**YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

**Undertaking #33**

- March 6, 2024 Transcript, page 442, lines 6-12: With reference to Exhibit 2 at pdf pages 193 and 194, a UCG IR [UCG-YEC-1-31(a)], and the table that was provided, to advise of the actual licence renewal costs, what they were for 2023 for each of the 5-year and 25-year renewals.

**YEC Response:**

The 2023 actual cost for the 5-year renewal was \$0.040 million and for the 25-year renewal was \$0.811 million, as indicated in response to Undertaking #31.

**YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

**Undertaking #34**

- March 7, 2024 Transcript, page 473, lines 5-7: To provide what those AFUDC costs were and the years that it was charged

**YEC Response:**

This undertaking arises from Board counsel’s question in the March 7, 2024 Transcript on page 472, lines 5-6 about the amount of AFUDC that was included in the previously disallowed \$7.078 million amount for the WH2 Uprate Project that YEC is seeking to include in the rate base effective January 1, 2023.

Please note that YEC did not identify or track the disallowed costs for the WH2 Uprate Project separately, and that AFUDC was charged on the total project cost. However, YEC estimates that the previously disallowed costs of \$7.078 million included approximately \$0.175 million AFUDC. This estimate is based on the total AFUDC for the project (as set out below), and the proportion of the total project cost that was previously disallowed.

AFUDC	\$000
2018	\$1.69
2019	\$34.11
2020	\$98.03
2021	\$183.32
<b>Total</b>	<b>\$317.15</b>

**Total Project Cost \$12,814.33**

AFUDC Related to \$7.08 million	\$175.18
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**YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

**Undertaking #35**

- March 7, 2024 Transcript, page 473, lines 22-24: To advise what amounts of AFUDC was included in that \$789,000, and in which years

**YEC Response:**

This undertaking arises from Board counsel's questions in the March 7, 2024 Transcript on page 473, lines 8-21 about the amount of AFUDC that was included in the previously disallowed \$0.789 million amount for the WH4 Servomotor Replacement Project that YEC is seeking to include in the rate base effective January 1, 2023.

Please note that YEC did not identify or track the disallowed costs for the WH4 Servomotor Replacement Project separately, and that AFUDC was charged on the total project cost. However, YEC estimates the previously disallowed costs of \$0.789 million included approximately \$0.019 million AFUDC. This estimate is based on the total AFUDC for the project (as set out below), and the proportion of the total project cost that was previously disallowed.

AFUDC	\$000
2018	\$0.14
2019	\$2.22
2020	\$7.16
2021	\$23.24
2022	\$0.14
<b>Total</b>	<b>\$32.90</b>

**Total project cost \$1,337.14**

AFUDC Related to  
\$0.789 million \$19.41

## YEC 2023/24 GRA

Exhibit # \_\_\_\_\_

### Undertaking #36

- March 7, 2024 Transcript, page 475, line 25 – page 476, line 1-3: To provide what amounts of AFUDC were included in the over \$10 million and in which years were they charged.

### YEC Response:

This undertaking is concerned with the amount of AFUDC that was included in the combined cost of \$10.016 million for the PAMMS and EAM Projects set out in Exhibit 1, Table 5.6 (PDF p. 150).

Please see the table below for AFUDC related to the PAMMS and EAM Projects.

AFUDC \$000	PAMMS	EAM	Total
2018	\$1.8	\$2.0	\$3.8
2019	\$21.4	\$10.7	\$32.1
2020	\$63.5	\$59.3	\$122.8
2021	\$85.6	\$42.1	\$127.6
2022	\$100.9	\$0.0	\$100.9
2023	\$122.2	\$0.0	\$122.2
<b>Total</b>	<b>\$395.4</b>	<b>\$114.1</b>	<b>\$509.5</b>

## **YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

### **Undertaking #37**

- March 7, 2024 Transcript, page 478, lines 13-17: To advise whether the Minto Power Purchase Agreement had security provisions, and if so, whether the security provisions cover usage and electrical service costs in addition to construction costs.

### **YEC Response:**

YEC's February 8, 2007 Power Purchase Agreement ("PPA") with Minto Explorations Ltd. ("Minto") included a provision requiring Minto to execute a General Security Agreement ("GSA") granting YEC a charge over all of Minto's assets, as security for Minto's obligation to make certain payments to YEC, which included Minto's payment of monthly electrical service costs in addition to required contributions to construction costs. However, the GSA was discharged in or about April 2012, in accordance with the terms of the PPA (as amended), following Minto's payment of an agreed "Minimum Take or Pay Amount" for the supply of grid electricity, as well as an agreed Decommissioning Cost Payment.

As a result, the PPA was deemed to be amended to delete the security provisions in it, and there were no contractual security provisions still in effect at the relevant time of Minto's failure to pay certain YEC invoices for the supply of electricity in 2022 and 2023.

Although YEC does not have contractual security for the unpaid amounts under the PPA, YEC has deposited statutory lien claims under the *Miners Lien Act* in respect of those unpaid amounts, and has filed a Petition in the Yukon Supreme Court to seek to enforce those lien claims.

YEC's Petition to enforce its miners liens is currently stayed pending the resolution of Minto's receivership proceedings.

## YEC 2023/24 GRA

Exhibit # \_\_\_\_\_

### Undertaking #38

- March 7, 2024 Transcript, page 511, lines 1 – 5: To explain how the accounting entry for the Low Water Reserve Fund would be made when there was interest charged to the balance in the Low Water Reserve Fund.

### YEC Response:

The current LWRF Term Sheet as approved by the YUB in the 2021 GRA (and as approved and implemented in many prior years) includes the following provision for interest calculated on the fund balance (Exhibit 18):

The Fund is to attract interest based upon the short/intermediate term bond rates in which YEC may invest the Fund and any negative balances would only attract interest at the lowest short-term borrowing rate available to YEC through a line of credit.

The interest rate was determined in accordance with the March 11, 1996 letter that recorded the negotiated settlement in YEC's 1996/97 GRA [YEC 2017-18, GRA YUB-YEC-2-3(c) Attachment 1] and that was approved by YUB Order 1996-7. The negotiated settlement provided that the fund [the Diesel Contingency Fund at that time] was to attract interest based upon the short/intermediate term bond rates in which the utility may invest the fund, with any negative balances only attracting interest at the lowest short-term borrowing rate available to the utility through a line of credit.

In YUB Order 2022-03 (at paragraph 368), the Board directed YEC on a go-forward basis to treat the balance of the LWRF as an offset to rate base. YEC understood that this change removed the basis for the LWRF Term Sheet interest payment provision, and therefore YEC ceased calculating interest on the fund balance [this was confirmed with the YUB consultant during the review of the 2021 LWRF annual report].

Prior to YUB Order 2022-03, interest was calculated on the fund balance and the accounting journal entry was as follows:

<Debit> Net movement in regulatory differences  
<Credit> Low Water Reserve Fund (Balance Sheet)

When the fund balance is positive, the positive balance indicates a benefit to ratepayers; the fund balance therefore attracted interest prior to YUB Order 2022-03, and the calculated interest was added to the fund balance [i.e., increasing the balance]. Conversely, when the fund balance was negative, the calculated interest further reduced the fund balance prior to YUB Order 2022-03. This interest calculation had no impact on YEC earnings, since the calculated interest either reduced or increased the fund balance.

For example, as reviewed in Table 1-2 of the 2022 LWRF annual report filed with the YUB:

- since the 2018 ending balance was positive, the calculated interest was added to the fund, resulting in an increase of the fund balance, with no net impact on YEC earnings; and
- since the 2019 ending balance was negative, the calculated negative interest was deducted from the fund, resulting in a decrease of the fund balance, again with no net impact on YEC earnings.

**Table 1-2: LWRF Continuity Schedule**

Line	Activity	2017 (\$000s)	2018 (\$000s)	2019 (\$000s)	2020 (\$000s)	2021 (\$000s)	2022 (\$000s)
<b>A</b>	<b>Opening Balance</b>	<b>\$9,485</b>	<b>\$6,709</b>	<b>\$3,379</b>	<b>(\$3,900)</b>	<b>(\$4,272)</b>	<b>\$2,744</b>
B	Incremental Thermal Generation Cost to Charge(Refund) <sup>1</sup> to LWRF	\$0	\$534	\$6,268	\$352	(\$7,019)	(\$7,151)
C=B	Total LWRF operation for YEC						
	YEC pays to LWRF	\$0	\$0	\$0	\$0	\$7,019	\$7,151
	YEC withdraws from LWRF	\$0	(\$534)	(\$6,268)	(\$352)	\$0	\$0
D=A+C	LWRF Balance after Annual Operation	\$9,485	\$6,176	(\$2,889)	(\$4,252)	\$2,746	\$9,895
E	Interest on LWRF Balance <sup>2</sup>	\$86	\$76	(\$7)	(\$20)	(\$3)	
F=D+E	LWRF Balance after Interest charge	\$9,570	\$6,252	(\$2,896)	(\$4,272)	\$2,744	\$9,895
G	Rider E (Rebate)/Collections [January - December]	(\$2,861)	(\$2,874)	(\$1,004)	\$0	\$0	\$0
H=F+G	LWRF Ending Balance <sup>3</sup>	\$6,709	\$3,379	(\$3,900)	(\$4,272)	\$2,744	\$9,895
I	LWRF Cap <sup>4</sup>		+/-8000	+/-8000	+/-8000	+/-16000	+/-16000
J	LWRF Rebate/(Collections) Required		\$0	\$0	\$0	\$0	\$0

Notes:

- 2022 is based on calculations provided in Table 1-1. The calculations for the previous years are provided in the respective annual reports.
- As per YUB Order 2022-03 the LWRF is included in the rate base. Therefore, going forward no interest calculations on the LWRF balances.
- The negative balance indicates a cost to ratepayers, and the positive balance indicates a benefit to ratepayers.
- LWRF cap was increased to +/- \$16 million as per YUB Order 2022-03.

## **YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

### **Undertaking #39**

- March 7, 2024 Transcript, page 534, lines 11-17: To provide an answer to the question: "Now, with regard to the ten-year resource plan, do you have any estimate of how much that will cost? oh, and I'm sorry, it's the electricity plan, the ten-year electricity plan that you stated you're working on."

### **YEC Response:**

This undertaking is in connection with the Electricity Supply Plan (ESP) noted in response to YUB-YEC-1-1(a)-(c) (Exhibit 2, PDF page 215):

YEC is developing an Electricity Supply Plan to identify the resource options that can be implemented in the next 5-10 years to increase the supply of dependable capacity and energy during the winter months and reduce the use of rental diesels. The Electricity Supply Plan is expected to be released by mid-2024. It will consider the status of projects proposed in the 10-Year Renewable Electricity Plan and outline a workplan to meet Yukon's electricity needs in the next 10 years.

The total cost of developing the ESP is forecast to be about \$0.340 million. The ESP identifies the types of projects we need to meet electricity needs for the next 10-years. We know that projects require partnerships and federal funding in order to proceed. The processes to develop and implement projects have not been budgeted.

Please note that this cost forecast is for completing the ESP itself. Once the ESP is finalized, the next steps will be to issue an expression of interest, and evaluate proposals, select partners and move toward feasibility studies. The costs for those next steps are not included in the cost estimate.

## **YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

### **Undertaking #41**

- March 7, 2024 Transcript, page 566, lines 9-12: To confirm that Line 355 serves the village of Haines Junction and check the number of customers affected by the August 20, 2023 outage.

### **YEC Response:**

This undertaking is concerned with the August 20, 2023 outage described in Exhibit 17, as discussed on Transcript page 565, lines 19-21, rather than the August 3, 2023 outage referenced in the restatement of the undertaking question on Transcript page 566, line 12.

YEC confirms that L355 does feed Haines Junction. As Haines Junction is served by AEY at the distribution level, YEC reports AEY as one customer.

As YEC also has a small number of distribution level customers between the AH plant and the interface point with AEY, the eight customers indicated in Exhibit 17 as having been affected by the August 20, 2023 outage included AEY as one customer and seven additional YEC customers. YEC does not have information on the number of AEY customers impacted.

**YEC 2023/24 GRA**

**Exhibit #\_\_\_\_\_**

**Undertaking #42**

- March 7, 2024 Transcript, page 574, lines 3-4: To provide the external assessment referenced (see text).

**YEC Response:**

This undertaking is concerned with an external assessment that was done on DD4 in 2022.

That external assessment is attached as Attachment 1 to this undertaking response.



## Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988



### Job Scope:

Complete conditional monitoring and inspection of genset for issues and recommendations. Access any limitations or improvements to achieve maximum equipment output of 1440 KW. The customer has indicated high oil temp shutdowns have prevented achieving 1440 KW.

### Summary:

The Cat 3516 diesel genset is reported to have approximately 22,000 hours. During discussions with the power station operator and maintenance staff, no major vibration, mechanical or reliability issues were indicated. Maintenance staff stated no pertinent findings in their oil samples were noted. The unit is an 1800 rpm 1440 kW rated unit. Unit was loaded up to 1440 kW during the testing. It was reported that this unit does not normally run at 1440 kW load and is usually at 1000 kW. The maintenance staff indicated the radiator was recently washed as high oil temps were not achieved.

- The performance and vibration data indicated that the unit has some cylinders that need attention.
- The ultrasonic traces indicate some leakage at peak firing pressure on #2 & #16 cylinders.
- There was no evidence of excessive blow by at the piston rings, but the borescope inspection indicated multiple cylinders with little to no crosshatching remaining on the cylinder liners #1, 3, 4, 14, 16.
- Borescope inspection found cylinder head #13 with valve seat contamination / markings
- Prior to adjusting the engine valves, ultrasonic data showed intake and exhaust valve closure events where valve adjustments were tight on some cylinders, and #2 and #14 valves had double closing events.
- The connecting rod and main bearing vibration are within acceptable levels
- The water pumps and oil pump vibration are within acceptable levels
- The turbo vibration signatures are within acceptable levels
- The ultrasonic survey identified a leak on the turbo exhaust housing
- The intake airbox opening is pointed up towards to the exhaust which causes the intake air to be hotter than normal.
- The skid has some elevated 4x run speed vibration levels. The isolation pads on the unit are not secured to the concrete floor.
- The unit leaks quite a bit from the top end through valve cover and head gaskets.

Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

**Background:**

Previous Inspection Results	This is the first analysis completed by Collicutt Energy
History of Vibration Concerns or Failures	No history of vibration issues or failure were indicated. Cat maintenance indicates an overhaul at 24,000 hours
Description of Operating Control	The unit runs at 1800 rpm and is synchronized to the grid. Load is controlled remotely and is normally loaded to 90%. The unit is a “standby or emergency” application and does not usually run as a prime power unit.
Operating History	The unit has approximately 22,000 hours according to the panel mounted hour meter. Data tag indicates the crankshaft has previously been ground 0.025” on the main bearing and rod bearing journals.

Finding	Observations	Recommendations	Data / Photos (Page #)
1	<b>Engine, Power cylinder #2, &amp; #16</b> – Ultrasonics show some evidence of leakage at and around peak firing pressure.	Replace cylinder liners and piston rings	18
2	<b>Engine, Power cylinder # 1, 3, 4, 14, &amp; 16</b> – Borescope inspection indicates cylinder liner wear.	Replace cylinder liners and piston rings	18
3	<b>Engine, Cylinder Head # 13</b> – Borescope inspection indicates valve seat contamination & exhaust leaking	Replace cylinder head	19
4	<b>Engine, Power cylinders #2, &amp; # 14</b> – Double closing events were noted in cylinder head ultrasonic traces.	Set valves as per OEM recommendations – corrected onsite*	19
5	<b>Top End</b> – There are significant valve cover and head gasket leaks	Replace gaskets at cylinder head replacement and or next service	20
6	<b>Generator Skid</b> – The isolation pads are not secure to the concrete floor. This is resulting in elevated vertical readings 4x’s recommended specifications.	Secure isolation pads to the concrete slab as per manufacturer recommendations.	21
7	<b>Engine, Exhaust</b> – The ultrasonic survey picked up a leak on the turbo exhaust	Replace seals	22
8	<b>Engine, Air Intake</b> – Air filter housings had the opening upwards pulling in air heated by the hot exhaust	Rotate the air filter housing minimum 90 degrees to the back of the generator and ideally pointing the opening directly down like the other units	23

Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

9	<b>Engine, Oil Cooler / Radiator –</b> Maintenance staff have indicated oil temp shut down at high engine load levels. Could not duplicate onsite.	<ul style="list-style-type: none"> <li>• Test and inspect oil cooler internals for contamination or defects, replace oil cooler at next engine overhaul interval</li> <li>• Flush the radiator cores and piping with a flushing agent and replace the coolant to improve the coolers efficiency</li> </ul>	NA
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Red – Highest Priority, Urgent
Yellow – High Priority
Blue – Moderate Importance
No Color – Notable

**Engine Assessment:**

Cylinder	1	3	5	7	9	11	13	15	2	4	6	8	10	12	14	16
Cylinder Assessment																
Combustion Blowdown	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Valve Dynamics	Green	Green	Green	Green	Green	Green	Green	Green	Red	Red	Green	Green	Green	Green	Red	Green
Peak Firing Leaks	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	Green	Red
Ignition	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Borecope Inspection	Red	Red	Green	Green	Green	Green	Red	Green	Green	Red	Green	Green	Green	Green	Red	Red
Engine Assessment																
Loading Appropriate	Green															
Bearing Knocks	Green															
Crankcase Pressure / Blowby	Green															
Oil Level	Green															
Oil Usage Trend	Green															
Exhaust Back Pressure	Green															
Intake Restriction	Green															
Good																
Possible Improvement																
Requires Work																

Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

Operational Testing:

Speed (RPM)	1800
Load (kW)	1350

Manual Reading Name	Reading	Date	Time
1> Power 2 Exhaust Temp	1050.0	9-12-22	10:09:02
2> Power 4 Exhaust Temp	990.00	9-12-22	10:09:10
3> Power 6 Exhaust Temp	1000.0	9-12-22	10:09:15
4> Power 8 Exhaust Temp	1020.0	9-12-22	10:09:23
5> Power 10 Exhaust Temp	1020.0	9-12-22	10:09:28
6> Power 12 Exhaust Temp	1025.0	9-12-22	10:09:35
7> Power 14 Exhaust Temp	1000.0	9-12-22	10:09:41
8> Power 16 Exhaust Temp	990.00	9-12-22	10:09:48
9> Power 1 Exhaust Temp	1000.0	9-12-22	10:09:55
10> Power 3 Exhaust Temp	1020.0	9-12-22	10:10:03
11> Power 5 Exhaust Temp	1000.0	9-12-22	10:10:09
12> Power 7 Exhaust Temp	1010.0	9-12-22	10:10:14
13> Power 9 Exhaust Temp	1000.0	9-12-22	10:10:20
14> Power 11 Exhaust Temp	1000.0	9-12-22	10:10:25
15> Power 13 Exhaust Temp	990.00	9-12-22	10:10:31
16> Power 15 Exhaust Temp	1000.0	9-12-22	10:10:41
17> Engine Oil Temp Out	100.85 (°C)	9-12-22	10:10:43
18> Engine Oil Temp In	82.63 (°C)	9-12-22	10:11:06
19> Engine Water Jacket Temp Out	84.29 (°C)	9-12-22	10:11:16
20> Engine Water Jacket Temp In	76.79 (°C)	9-12-22	10:11:21
21> Engine Even Bank Air Man Temp	137.63 (°C)	9-12-22	10:11:57
22> Engine Odd Bank Air Man Temp	140.52 (°C)	9-12-22	10:11:35
23> Ambient Temperature	15.85 (°C)	9-12-22	10:11:45
24> Bearing Oil Pressure	60.00	9-12-22	10:12:20
25> Engine Torque Percent	1265.0	9-12-22	10:12:48
26> Unit Speed	1800.0	9-12-22	10:12:39
27> Total Unit Hours	20797.0	9-12-22	10:13:05

Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

Station: Yukon Energy  
 Machine: Yukon Energy DD4 3516 1800rpm 1440kw

Point	Description	Channel Number	Current Overall	Units	Previous Overall	Previous Date	Overall Limit	Percent of Limit	
Eng Mn Brg	1 Vel	1	0.4125	in/sec	0	No data	0.7	58.9	
Eng Mn Brg	1 Accel	1	1.406	g's	0	No data	2.5	56.2	
Eng Mn Brg	2 Vel	1	0.5904	in/sec	0	No data	0.7	84.3	
Eng Mn Brg	2 Accel	1	2.184	g's	0	No data	2.5	87.4	
Eng Mn Brg	3 Vel	1	0.6941	in/sec	0	No data	0.7	99.2	
Eng Mn Brg	3 Accel	1	2.467	g's	0	No data	2.5	98.7	
Eng Mn Brg	4 Vel	1	0.6775	in/sec	0	No data	0.7	96.8	
Eng Mn Brg	4 Accel	1	2.022	g's	0	No data	2.5	80.9	
Eng Mn Brg	5 Vel	1	0.675	in/sec	0	No data	0.7	96.4	
Eng Mn Brg	5 Accel	1	2.29	g's	0	No data	2.5	91.6	
Eng Mn Brg	6 Vel	1	0.7021	in/sec	0	No data	0.7	100.3	*
Eng Mn Brg	6 Accel	1	2.313	g's	0	No data	2.5	92.5	
Eng Mn Brg	7 Vel	1	0.6787	in/sec	0	No data	0.7	97.0	
Eng Mn Brg	7 Accel	1	2.043	g's	0	No data	2.5	81.7	
Eng Mn Brg	8 Vel	1	0.7672	in/sec	0	No data	0.7	109.6	*
Eng Mn Brg	8 Accel	1	3.257	g's	0	No data	2.5	130.3	*
Eng Mn Brg	9 Vel	1	0.5195	in/sec	0	No data	0.7	74.2	
Eng Mn Brg	9 Accel	1	2.141	g's	0	No data	2.5	85.7	
Gen Inboard	Horiz Vel	1	0.731	in/sec	0	No data	1.35	54.1	
Gen Inboard	Horiz Accel	1	1.383	g's	0	No data	2.5	55.3	
Gen Inboard	Vert Vel	1	0.4486	in/sec	0	No data	1.35	33.2	
Gen Inboard	Vert Accel	1	1.411	g's	0	No data	2.5	56.4	
Gen Inboard	Axial Vel	1	0.4936	in/sec	0	No data	1.35	36.6	
Gen Inboard	Axial Accel	1	1.008	g's	0	No data	2.5	40.3	
Gen Outboard	Horiz Vel	1	0.8292	in/sec	0	No data	1.35	61.4	
Gen Outboard	Horiz Accel	1	1.152	g's	0	No data	2.5	46.1	
Gen Outboard	Vert Vel	1	0.5684	in/sec	0	No data	1.35	42.1	
Gen Outboard	Vert Accel	1	0.8627	g's	0	No data	2.5	34.5	
Gen Outboard	Axial Vel	1	0.533	in/sec	0	No data	1.35	39.5	
Gen Outboard	Axial Accel	1	1.075	g's	0	No data	2.5	43.0	
Eng Frame	Left Front Vel	1	0.7741	in/sec	0	No data	0.2	387.0	*
Eng Frame	Left Front Vel	2	0.5646	in/sec	0	No data	0.2	282.3	*
Eng Frame	Left Front Vel	3	0.3138	in/sec	0	No data	0.2	156.9	*
Skid Frame	Eng Left Front Vel	1	1.372	in/sec	0	No data	0.15	914.7	*
Skid Frame	Eng Left Front Vel	2	0.6346	in/sec	0	No data	0.15	423.1	*
Skid Frame	Eng Left Front Vel	3	0.397	in/sec	0	No data	0.15	264.7	*
Eng Frame	Left Mid Vel	1	0.5187	in/sec	0	No data	0.2	259.3	*
Eng Frame	Left Mid Vel	2	0.651	in/sec	0	No data	0.2	325.5	*
Eng Frame	Left Mid Vel	3	0.7689	in/sec	0	No data	0.2	384.4	*
Skid Frame	Eng Left Mid Vel	1	1.063	in/sec	0	No data	0.15	708.7	*
Skid Frame	Eng Left Mid Vel	2	0.8312	in/sec	0	No data	0.15	554.2	*
Skid Frame	Eng Left Mid Vel	3	0.4364	in/sec	0	No data	0.15	291.0	*
Eng Frame	Left Rear Vel	1	0.9503	in/sec	0	No data	0.2	475.1	*
Eng Frame	Left Rear Vel	2	0.9495	in/sec	0	No data	0.2	474.7	*
Eng Frame	Left Rear Vel	3	0.2938	in/sec	0	No data	0.2	146.9	*
Skid Frame	Eng Left Rear Vel	1	1.278	in/sec	0	No data	0.15	851.8	*
Skid Frame	Eng Left Rear Vel	2	0.6558	in/sec	0	No data	0.15	437.2	*
Skid Frame	Eng Left Rear Vel	3	0.3088	in/sec	0	No data	0.15	205.9	*
Gen Left	Foot Vel	1	0.8819	in/sec	0	No data	0.2	440.9	*
Gen Left	Foot Vel	2	0.7025	in/sec	0	No data	0.2	351.2	*
Gen Left	Foot Vel	3	0.5161	in/sec	0	No data	0.2	258.1	*
Skid Gen	Left Foot Vel	1	1.991	in/sec	0	No data	0.15	1327.1	*
Skid Gen	Left Foot Vel	2	1.024	in/sec	0	No data	0.15	682.5	*
Skid Gen	Left Foot Vel	3	0.4699	in/sec	0	No data	0.15	313.3	*
Eng Frame	Right Front Vel	1	0.7414	in/sec	0	No data	0.2	370.7	*
Eng Frame	Right Front Vel	2	0.4888	in/sec	0	No data	0.2	244.4	*
Eng Frame	Right Front Vel	3	0.3102	in/sec	0	No data	0.2	155.1	*
Skid Frame	Eng Right Front Vel	1	1.648	in/sec	0	No data	0.15	1098.8	*
Skid Frame	Eng Right Front Vel	2	0.8983	in/sec	0	No data	0.15	598.9	*
Skid Frame	Eng Right Front Vel	3	0.3178	in/sec	0	No data	0.15	211.8	*
Eng Frame	Right Mid Vel	1	0.5286	in/sec	0	No data	0.2	264.3	*
Eng Frame	Right Mid Vel	2	0.6898	in/sec	0	No data	0.2	344.9	*
Eng Frame	Right Mid Vel	3	0.2984	in/sec	0	No data	0.2	149.2	*
Skid Frame	Eng Right Mid Vel	1	5.469	in/sec	0	No data	0.15	3646.2	*
Skid Frame	Eng Right Mid Vel	2	1.523	in/sec	0	No data	0.15	1015.6	*

\* Overall Vibration Limit Exceeded

Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

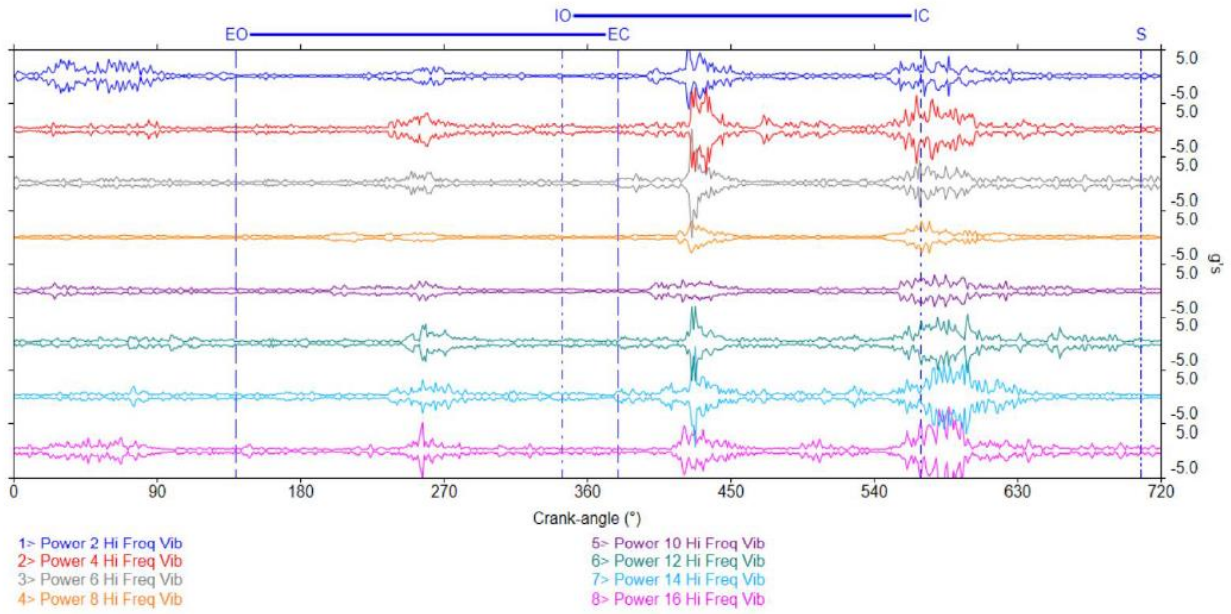
Vibration Report - Page 2

Point Description	Channel Number	Current Overall		Previous Overall	Previous Date	Overall Limit	Percent of Limit	
Skid Frame Eng Right Mid Vel	3	0.4253	in/sec	0	No data	0.15	283.5	*
Eng Frame Right Rear Vel	1	0.9255	in/sec	0	No data	0.2	462.7	*
Eng Frame Right Rear Vel	2	0.7316	in/sec	0	No data	0.2	365.8	*
Eng Frame Right Rear Vel	3	0.8398	in/sec	0	No data	0.2	419.9	*
Skid Frame Eng Right Rear Vel	1	1.074	in/sec	0	No data	0.15	715.7	*
Skid Frame Eng Right Rear Vel	2	0.5842	in/sec	0	No data	0.15	389.5	*
Skid Frame Eng Right Rear Vel	3	0.273	in/sec	0	No data	0.15	182.0	*
Gen Right Foot Vel	1	0.8706	in/sec	0	No data	0.2	435.3	*
Gen Right Foot Vel	2	1.027	in/sec	0	No data	0.2	513.7	*
Gen Right Foot Vel	3	0.3881	in/sec	0	No data	0.2	194.0	*
Skid Gen Right Foot Vel	1	2.022	in/sec	0	No data	0.15	1347.9	*
Skid Gen Right Foot Vel	2	0.8704	in/sec	0	No data	0.15	580.3	*
Skid Gen Right Foot Vel	3	0.3163	in/sec	0	No data	0.15	210.8	*
Oil Pump	1	2.59	in/sec	0	No data	0.5	518.1	*
Oil Pump	2	1.567	in/sec	0	No data	0.5	313.4	*
Oil Pump	3	1.805	in/sec	0	No data	0.5	361.0	*
Oil Pump Accel	1	19.33	g's	0	No data	6	322.1	*
Oil Pump Accel	2	4.986	g's	0	No data	6	83.1	*
Oil Pump Accel	3	6.013	g's	0	No data	6	100.2	*
JW Pump	1	0.5859	in/sec	0	No data	0.5	117.2	*
JW Pump	2	0.6559	in/sec	0	No data	0.5	131.2	*
JW Pump	3	1.093	in/sec	0	No data	0.5	218.7	*
JW Pump Accel	1	4.757	g's	0	No data	6	79.3	*
JW Pump Accel	2	4.247	g's	0	No data	6	70.8	*
JW Pump Accel	3	3.702	g's	0	No data	6	61.7	*
Left Turbo Horiz - Accel	1	2.691	g's	0	No data	6	44.9	*
Left Turbo Axial-Ac Low Fmax	1	3.241	g's	0	No data	6	54.0	*
Left Turbo Horiz - Vel	1	0.5727	in/sec	0	No data	0.7	81.8	*
Right Turbo Horiz - Accel	1	2.635	g's	0	No data	6	43.9	*
Right Turbo Axial-Ac Low Fmax	1	2.445	g's	0	No data	6	40.7	*
Right Turbo Horiz - Vel	1	0.7004	in/sec	0	No data	0.7	100.1	*
Lower Skid RT FRT Vert Vel	1	1.593	in/sec	0	No data	0.8	199.1	*
Floor RT FRT Vert Vel	1	0.05215	in/sec	0	No data	0.15	34.8	*
Eng Frame Right Mid Vert Vel	1	4.344	in/sec	0	No data	0.8	543.0	*
Floor RT Mid Vert Vel	1	0.2128	in/sec	0	No data	0.15	141.9	*
Eng Frame Right Rear Vert Vel	1	1.109	in/sec	0	No data	0.8	138.7	*
Lower Skid RT Rear Vert Vel	1	0.8599	in/sec	0	No data	0.8	107.5	*
Floor RT Rear Vert Vel	1	0.0347	in/sec	0	No data	0.15	23.1	*
Gen Frame Right Rear Vert Vel	1	1.031	in/sec	0	No data	1	103.1	*
Lower Skid Right Rear Gen Vert	1	0.9934	in/sec	0	No data	0.8	124.2	*
Floor Right Rear Gen Vert	1	0.2017	in/sec	0	No data	0.15	134.5	*

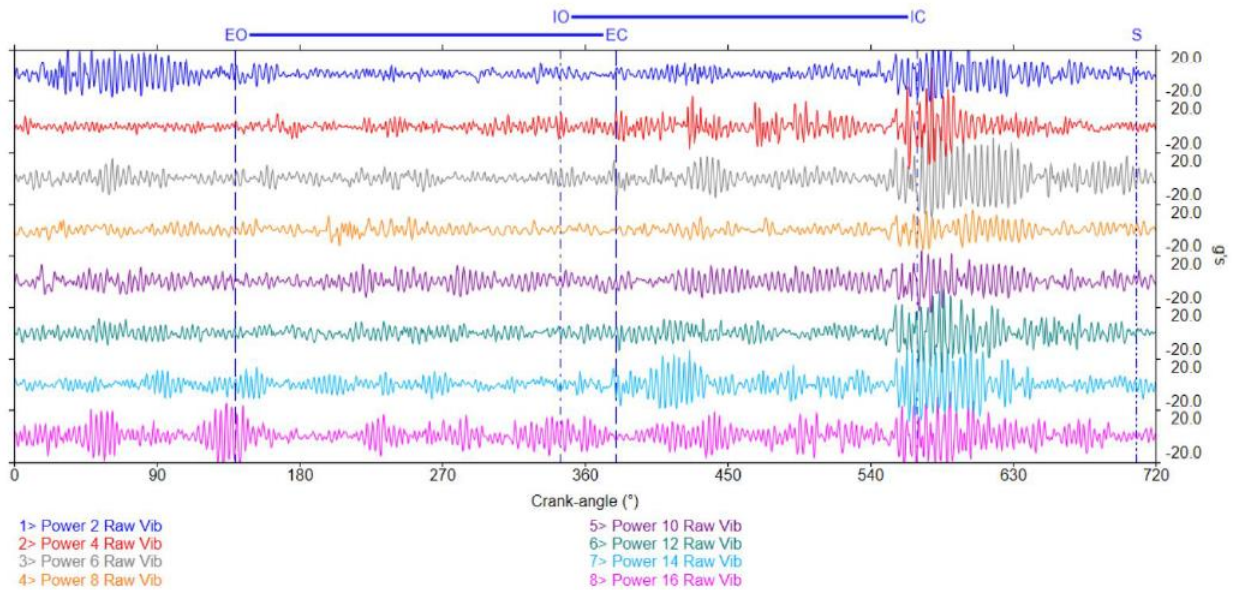
# Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

## Even Bank Vibration and Ultrasonic Traces

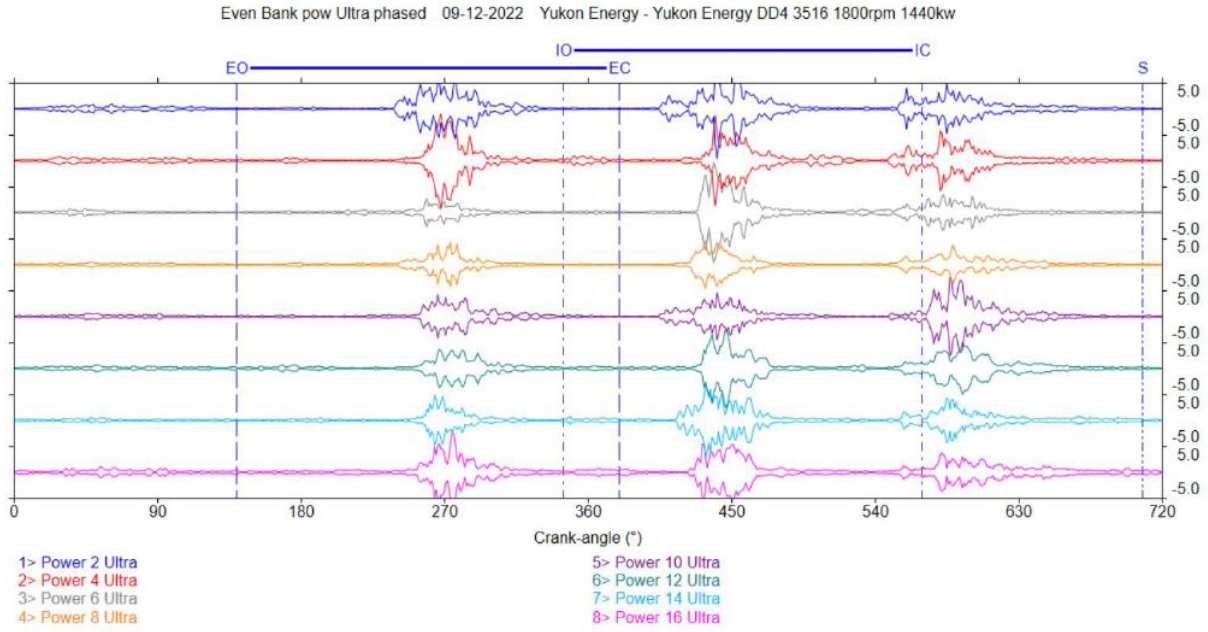
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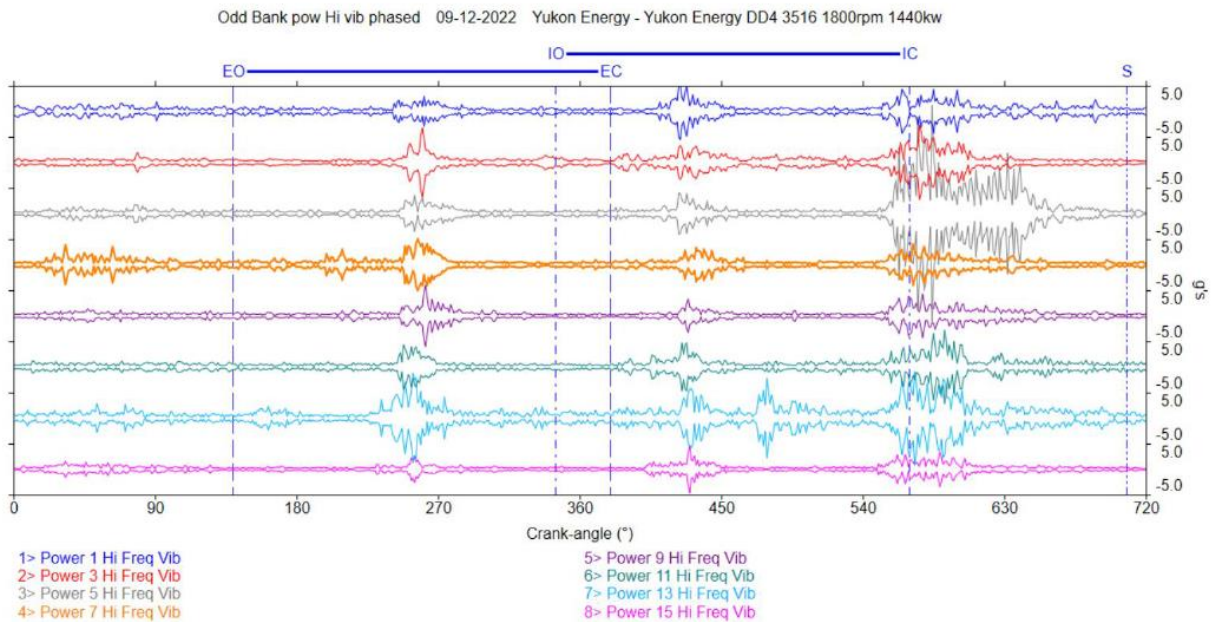
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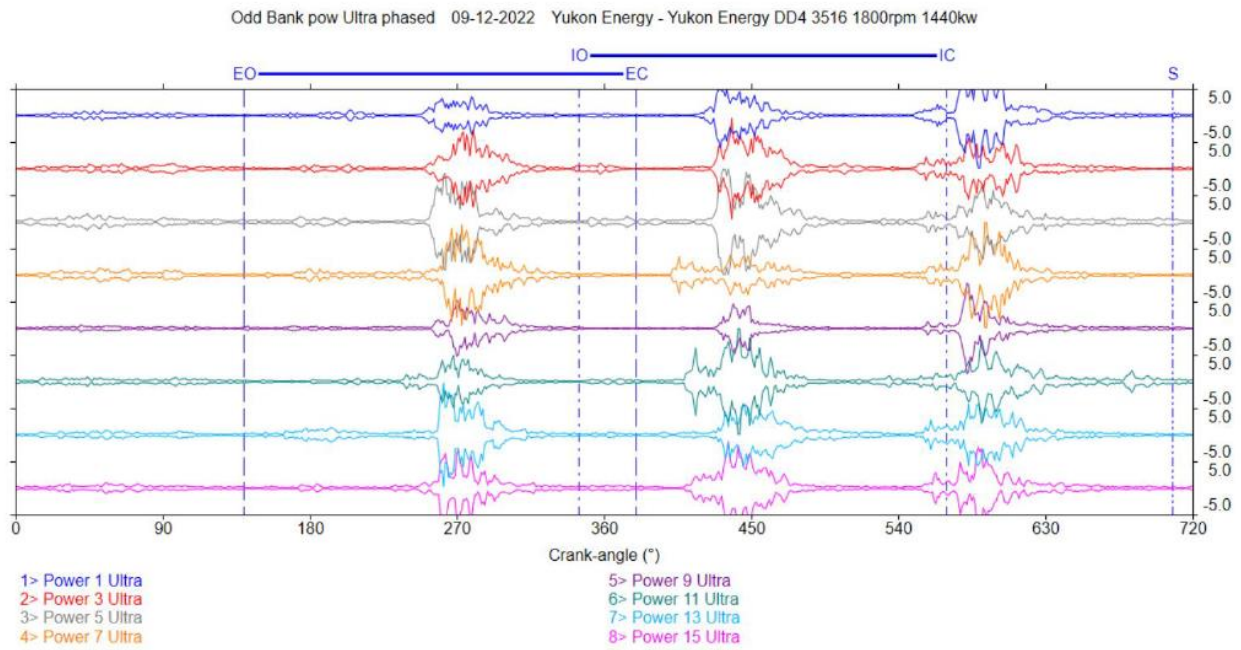
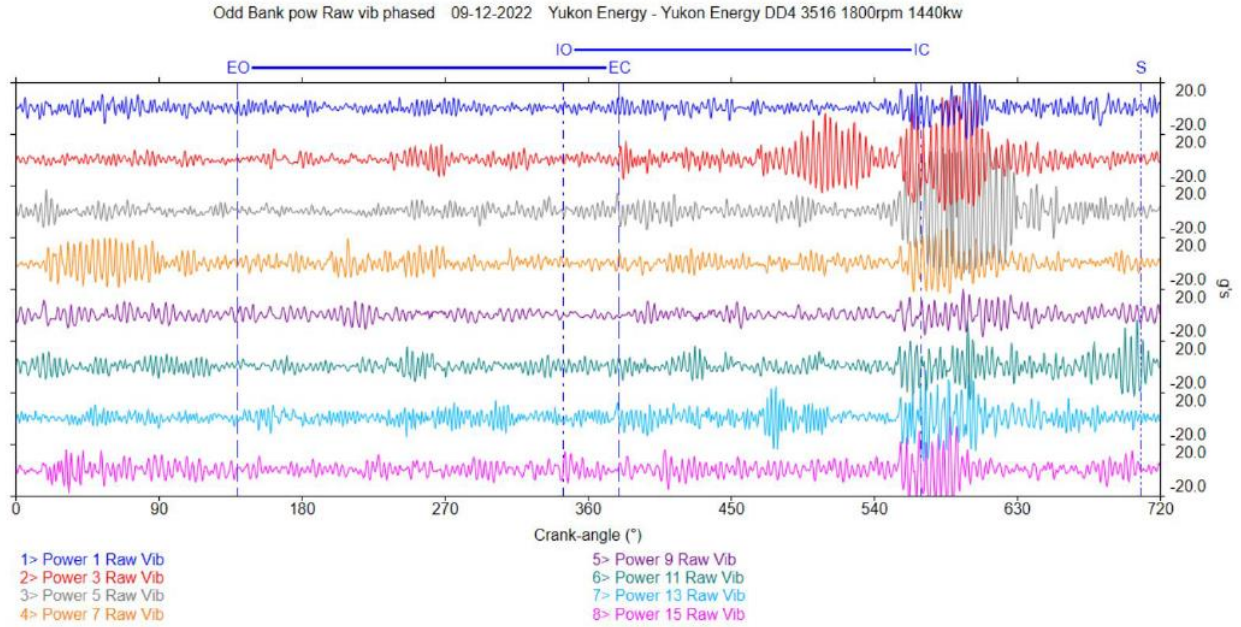
### Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988



### Odd Bank Vibration and Ultrasonic Traces



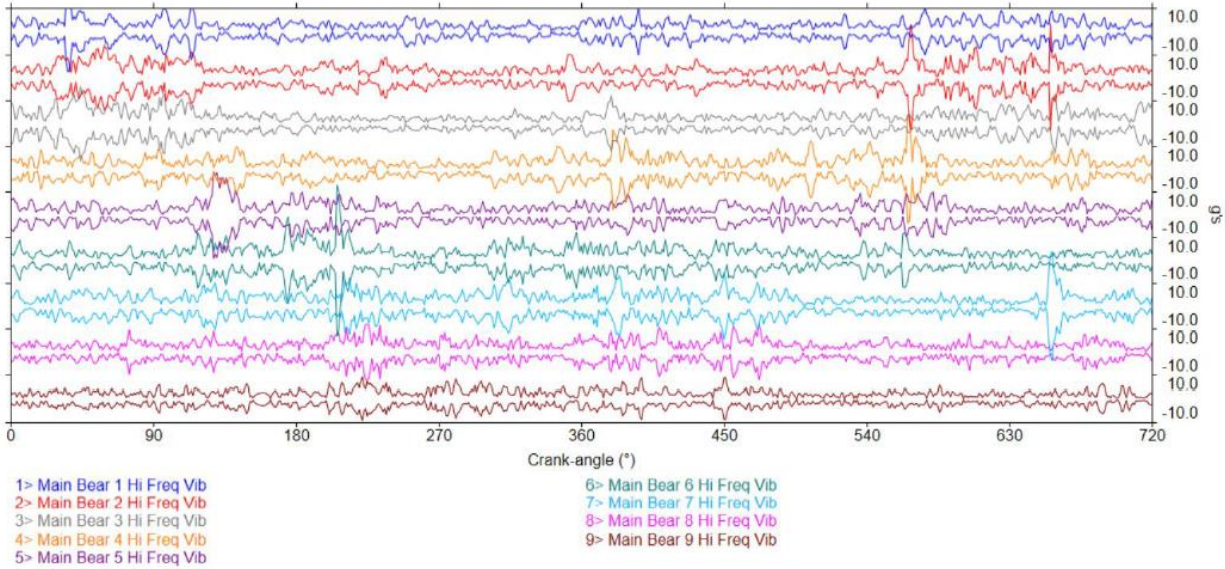
# Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988



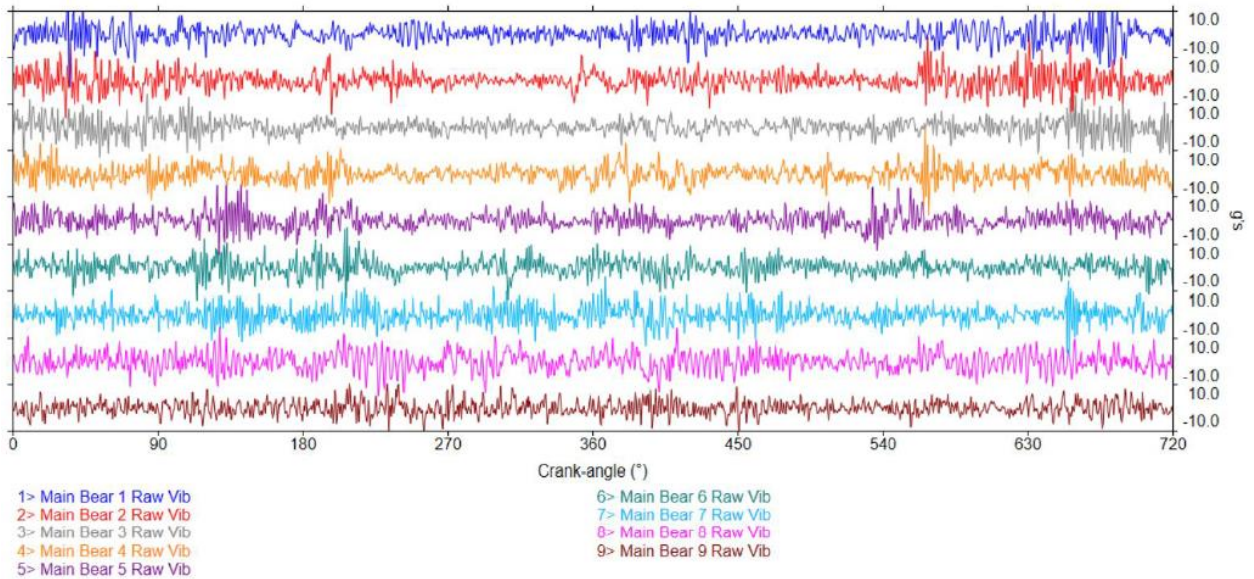
# Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

## Engine Main Bearing Vibration Traces

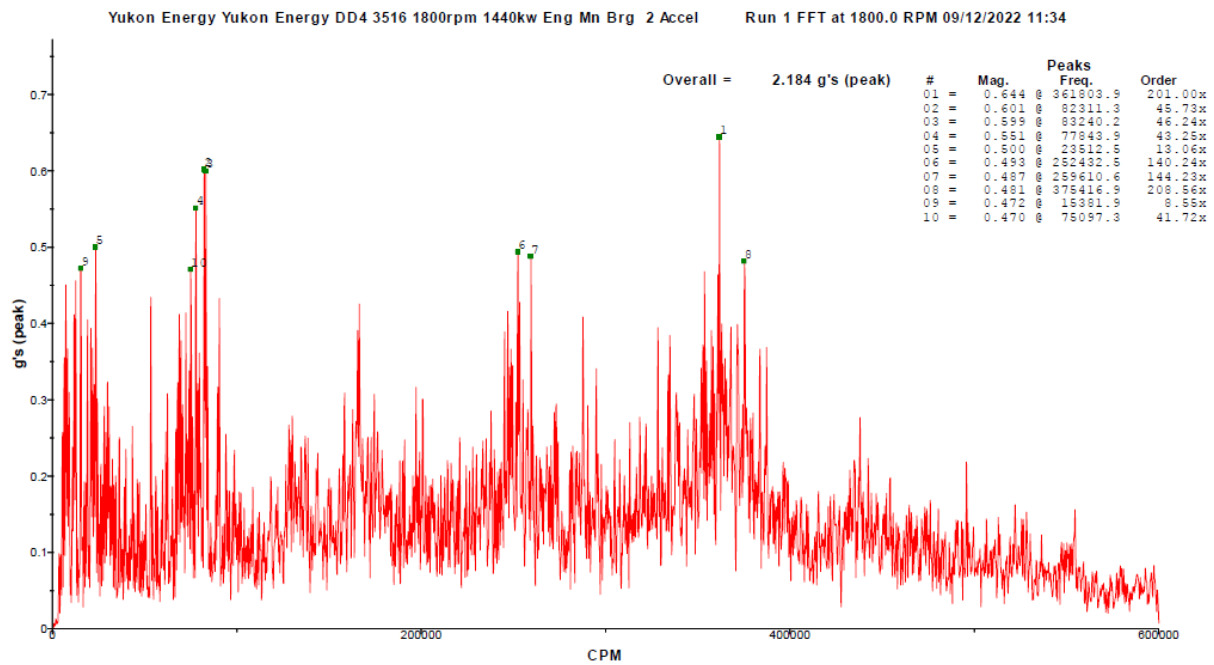
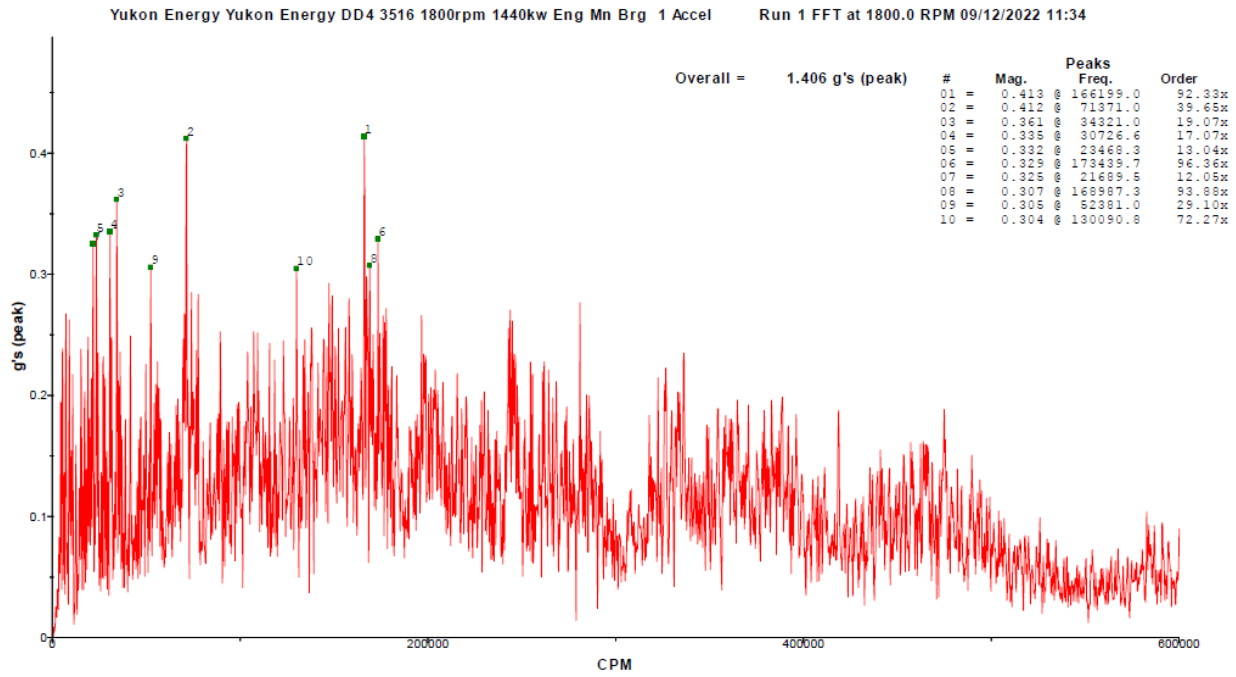
Eng Main Bear Hi Vib Phased G1 09-12-2022 Yukon Energy - Yukon Energy DD4 3516 1800rpm 1440kw



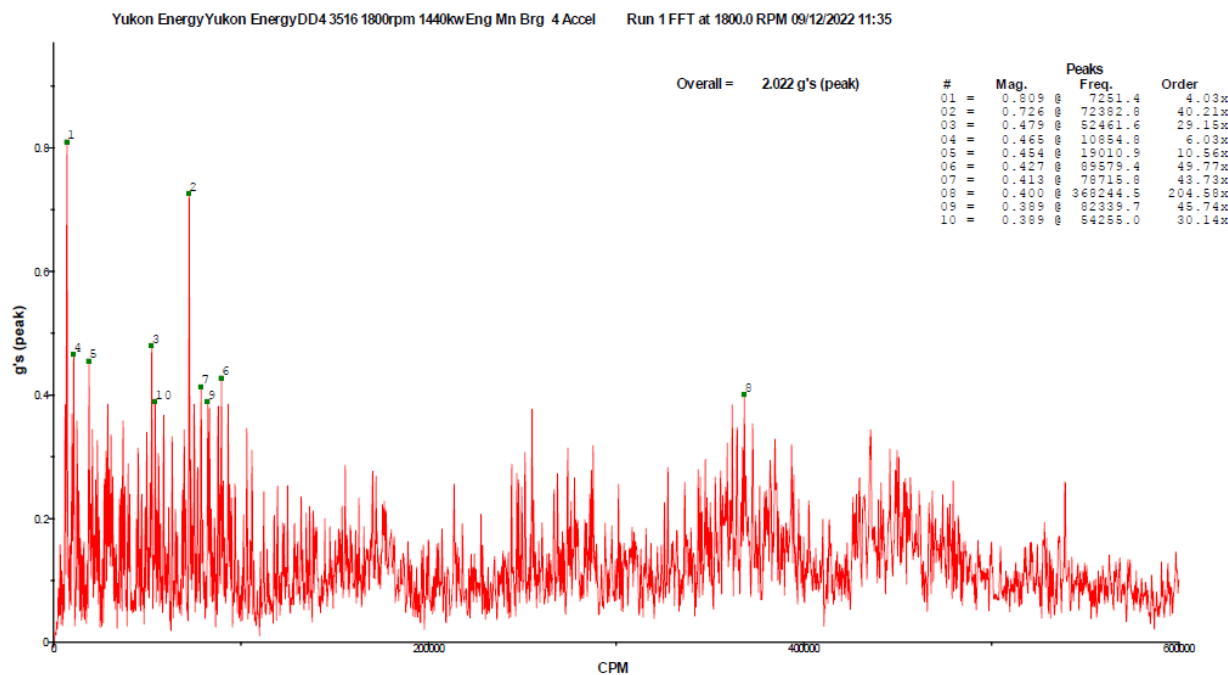
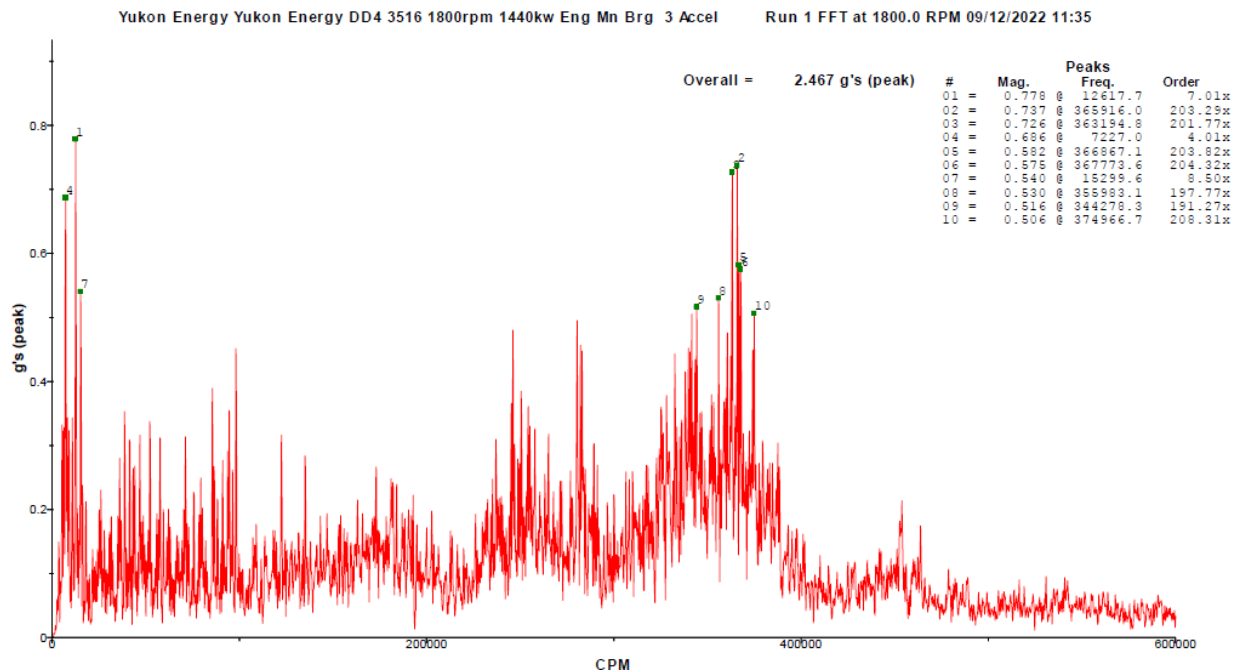
Eng Main Bear Raw Vib Phase G1 09-12-2022 Yukon Energy - Yukon Energy DD4 3516 1800rpm 1440kw



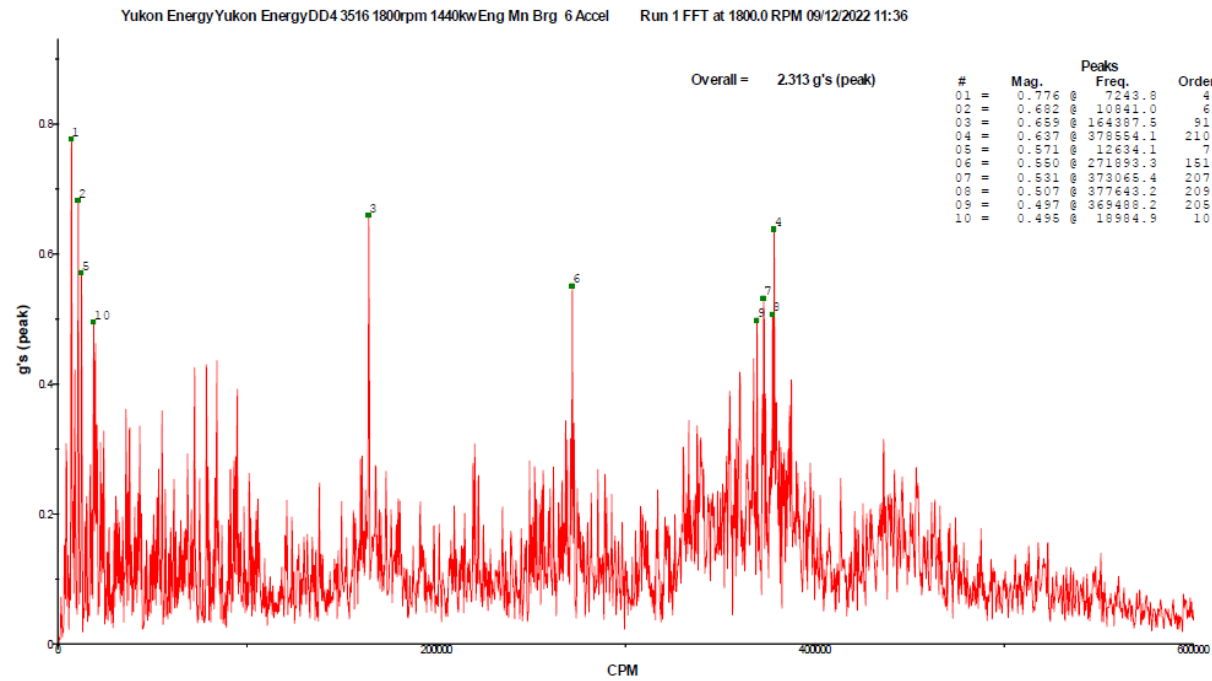
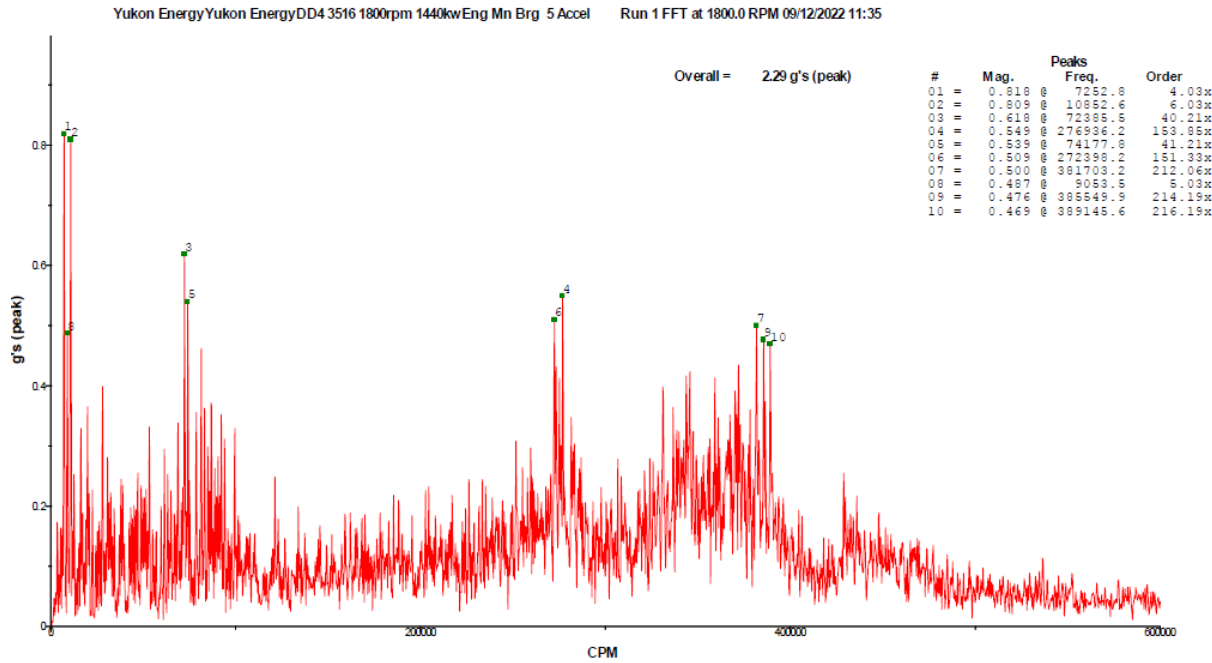
Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988



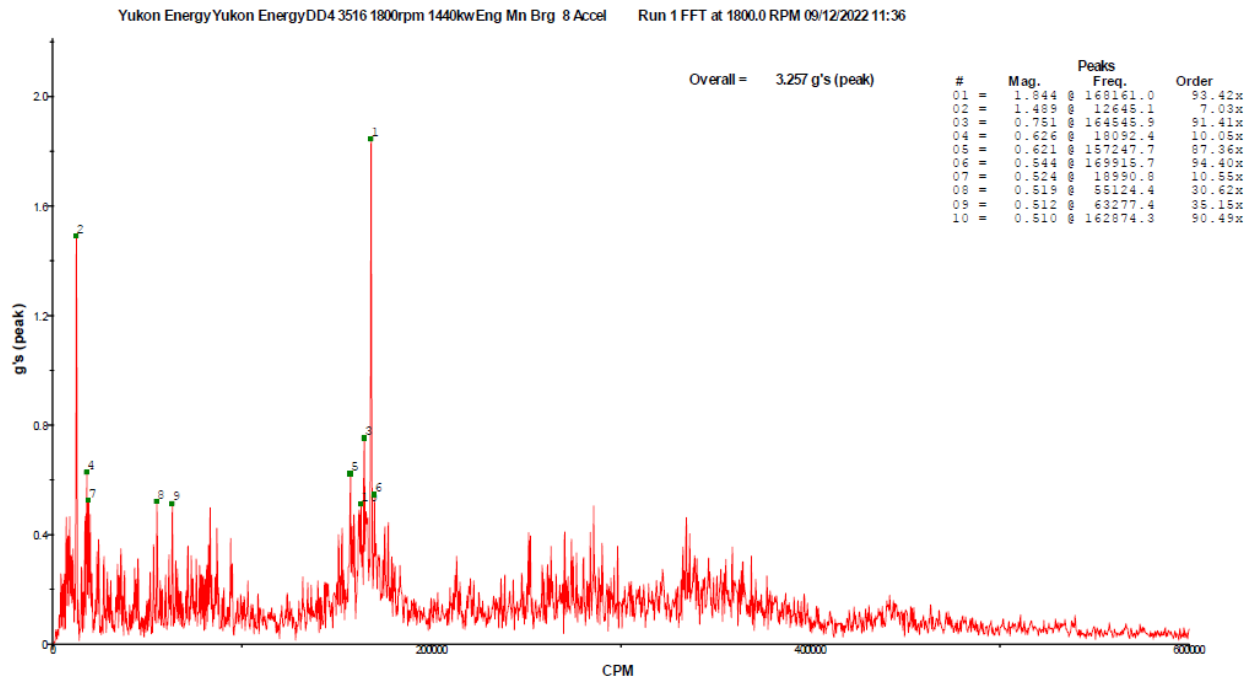
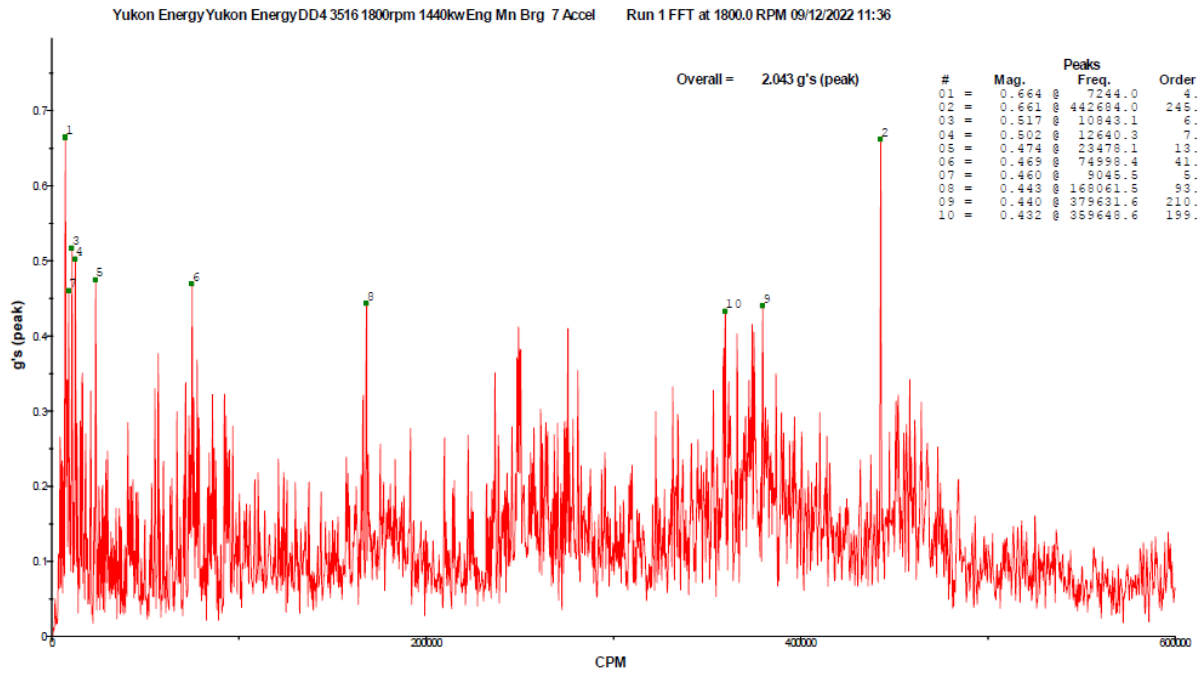
Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988



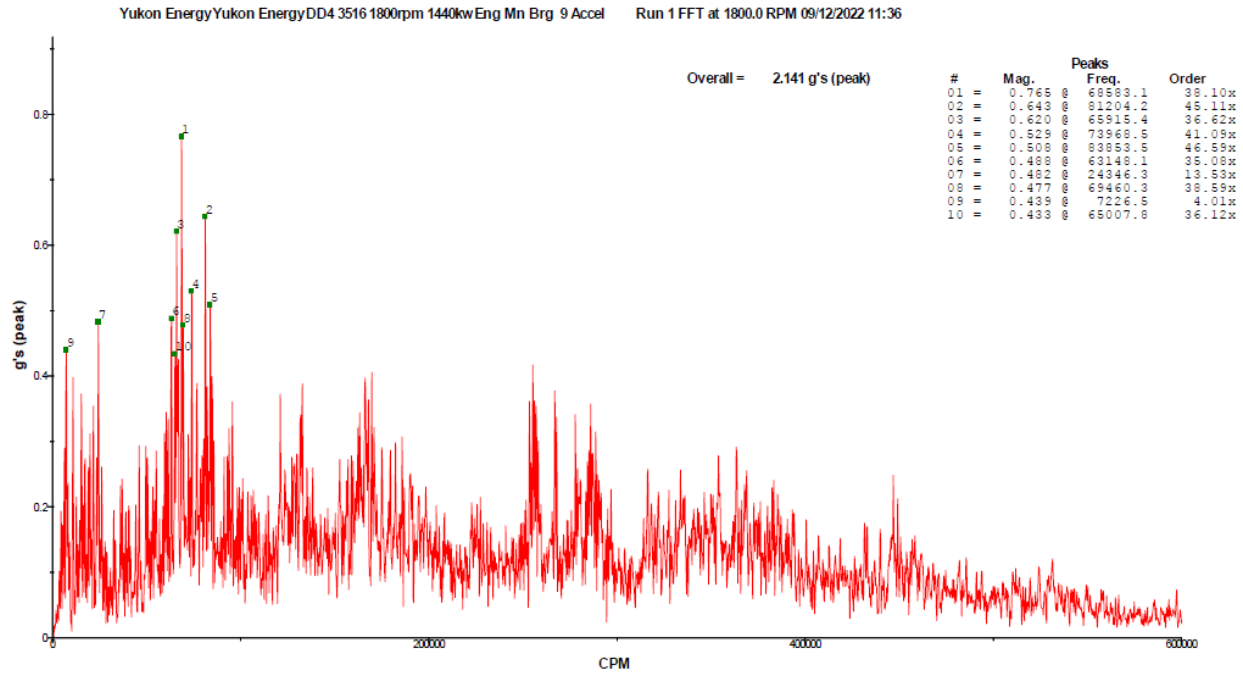
Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988



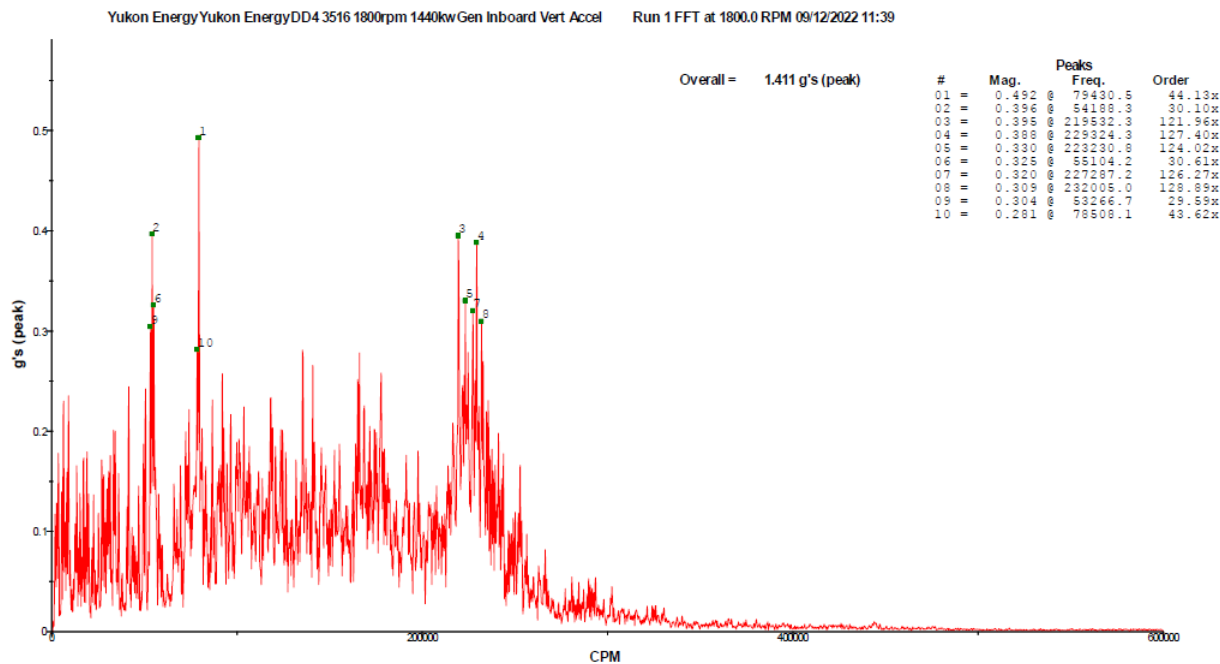
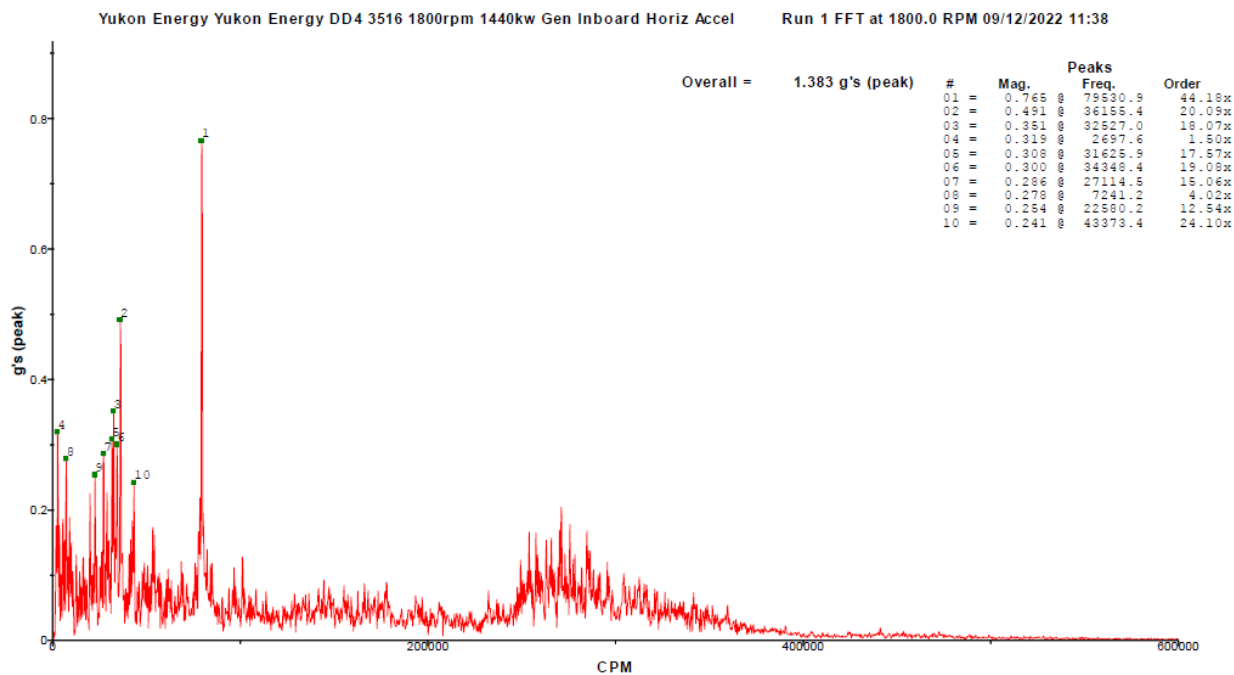
Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988



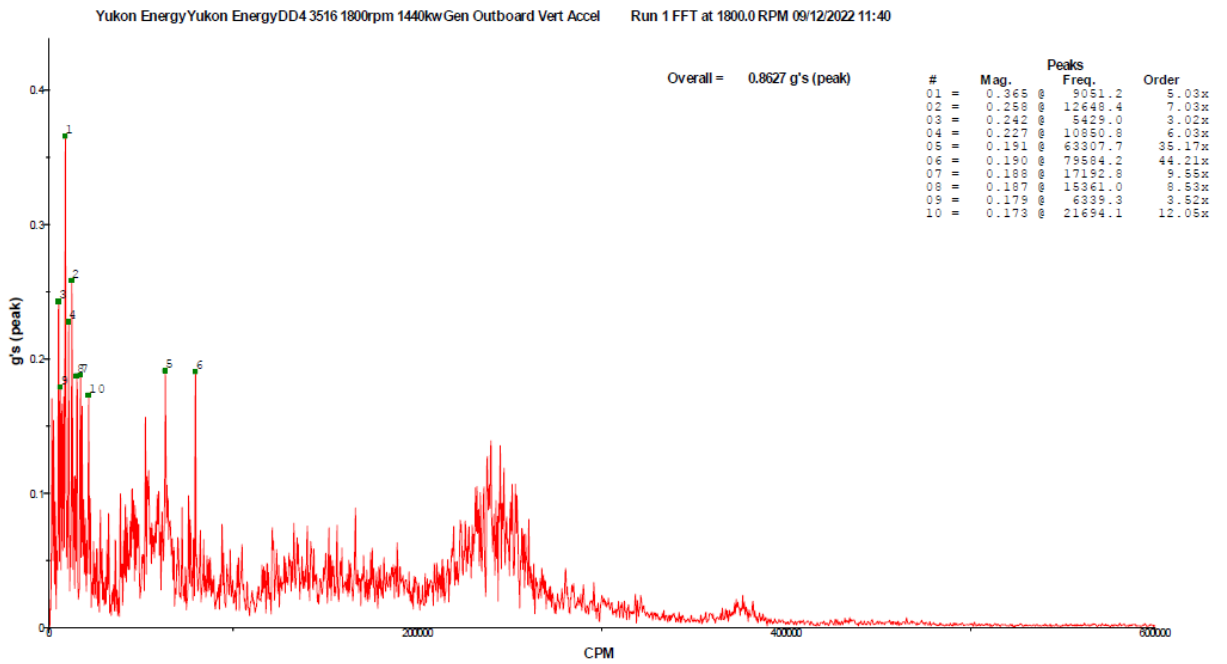
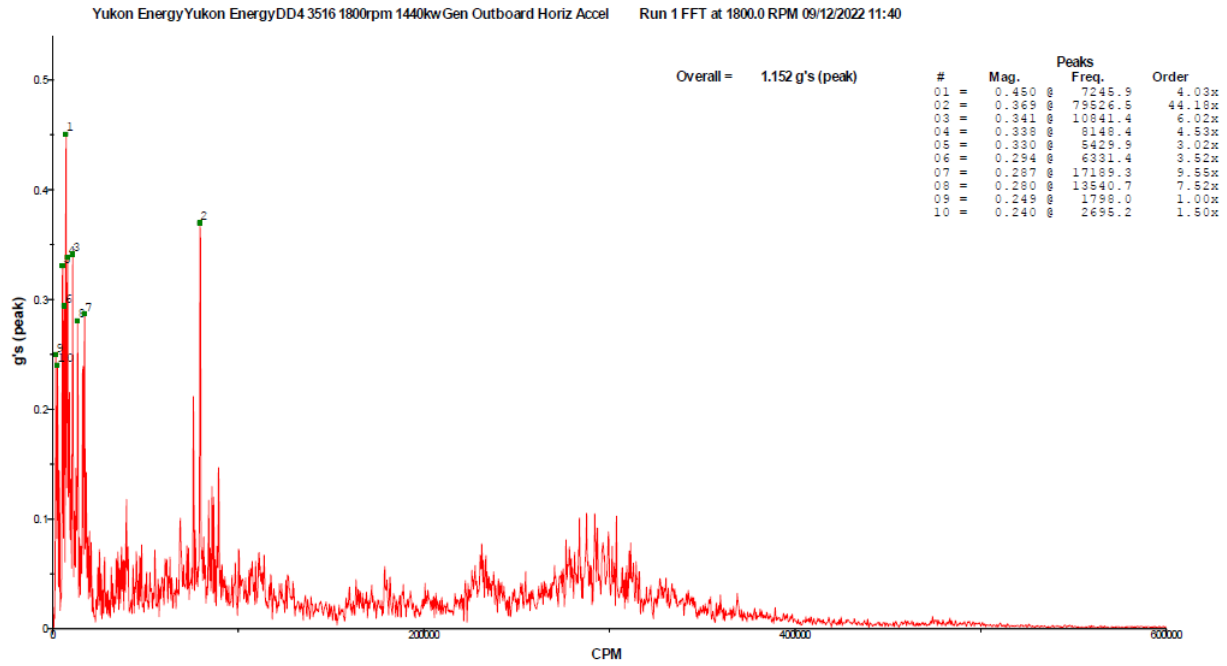
Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988



Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

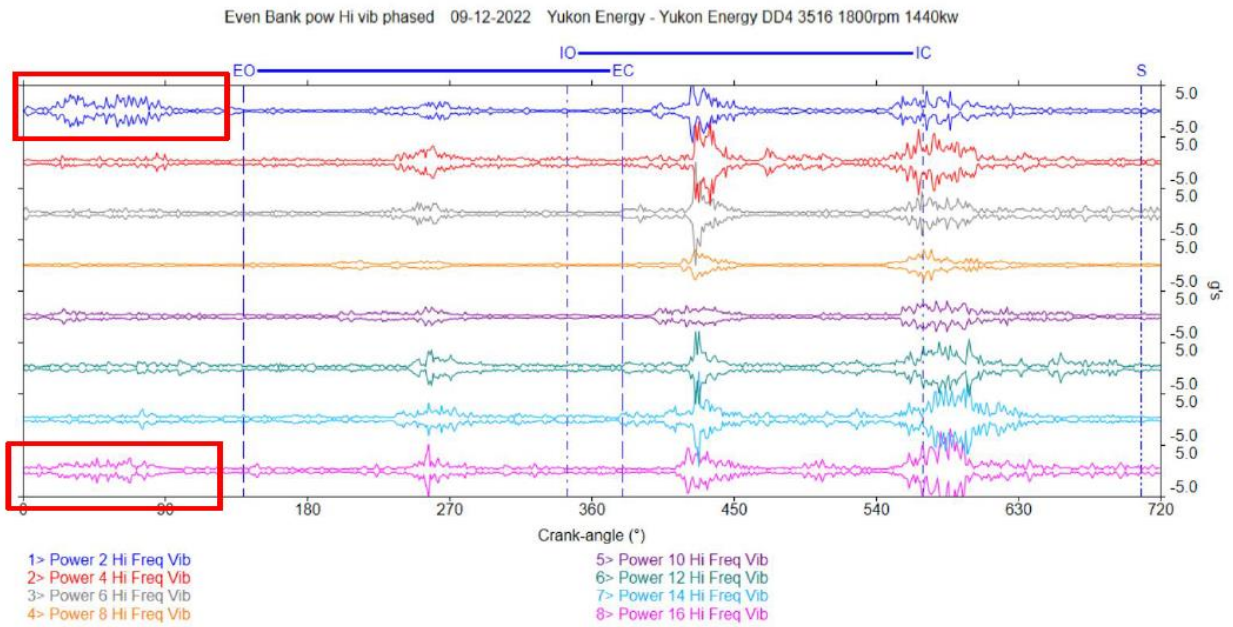


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**Finding #1 – Engine, Power cylinder #2 & #16 – Leaking at peak firing pressure**

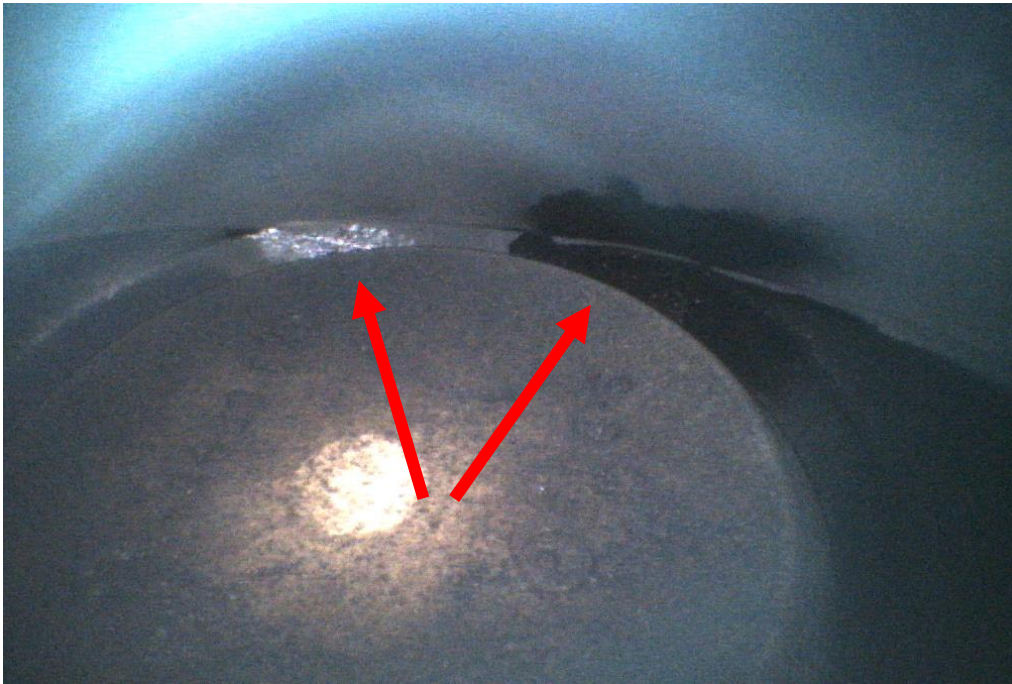


**Finding #2 – Engine, Power cylinder #1, 3, 4, 14, & 16 – Liner wear**

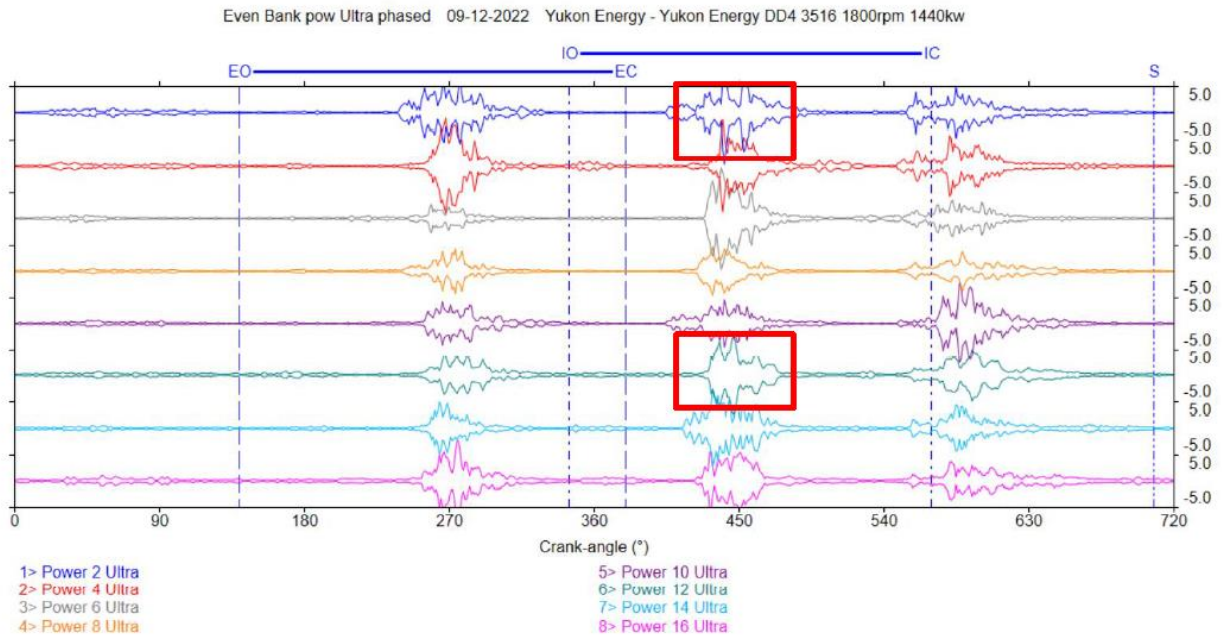


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**Finding #3 – Engine, Cylinder Head #13 – Valve seat**

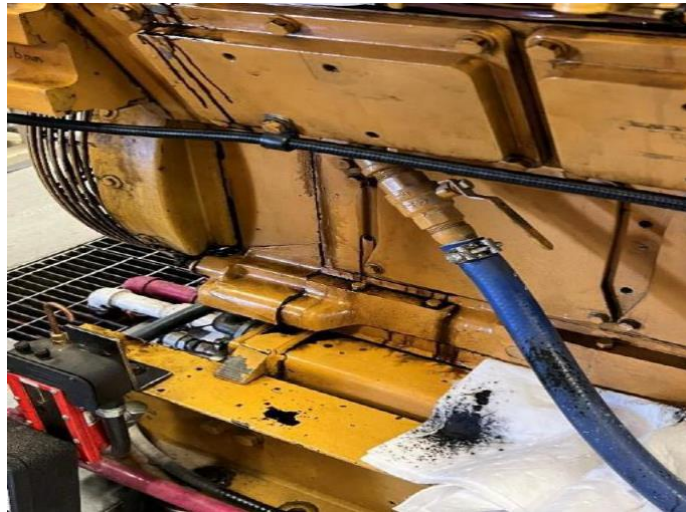
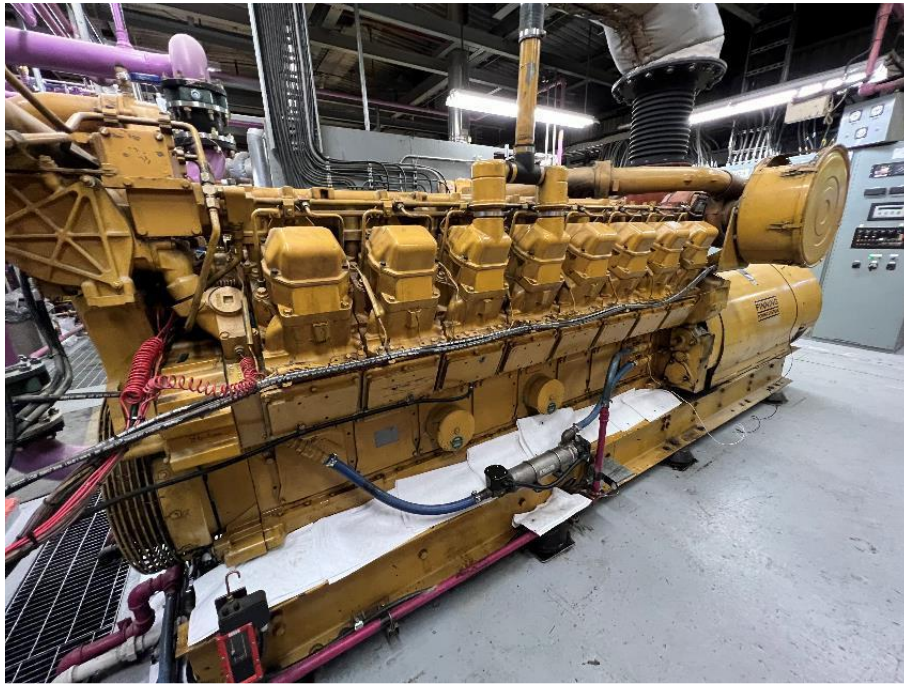


**Finding #4 – Engine, Power Cylinder #2 & #14 – Double closing event**



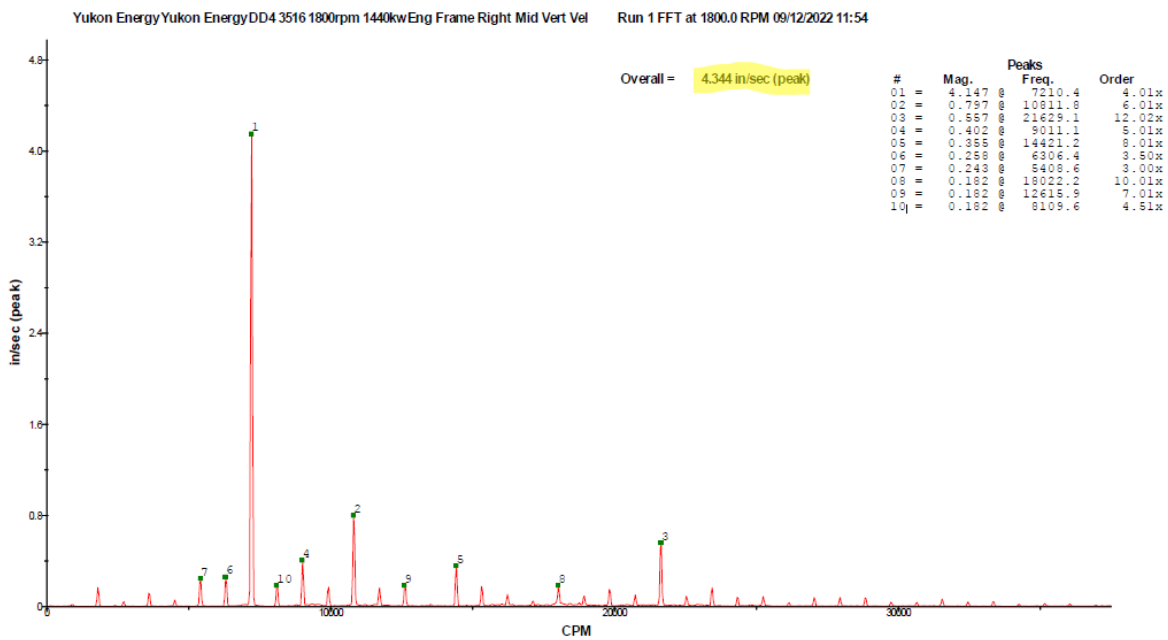
Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

**Finding #5 – Top End – Valve cover and head gasket leaks**



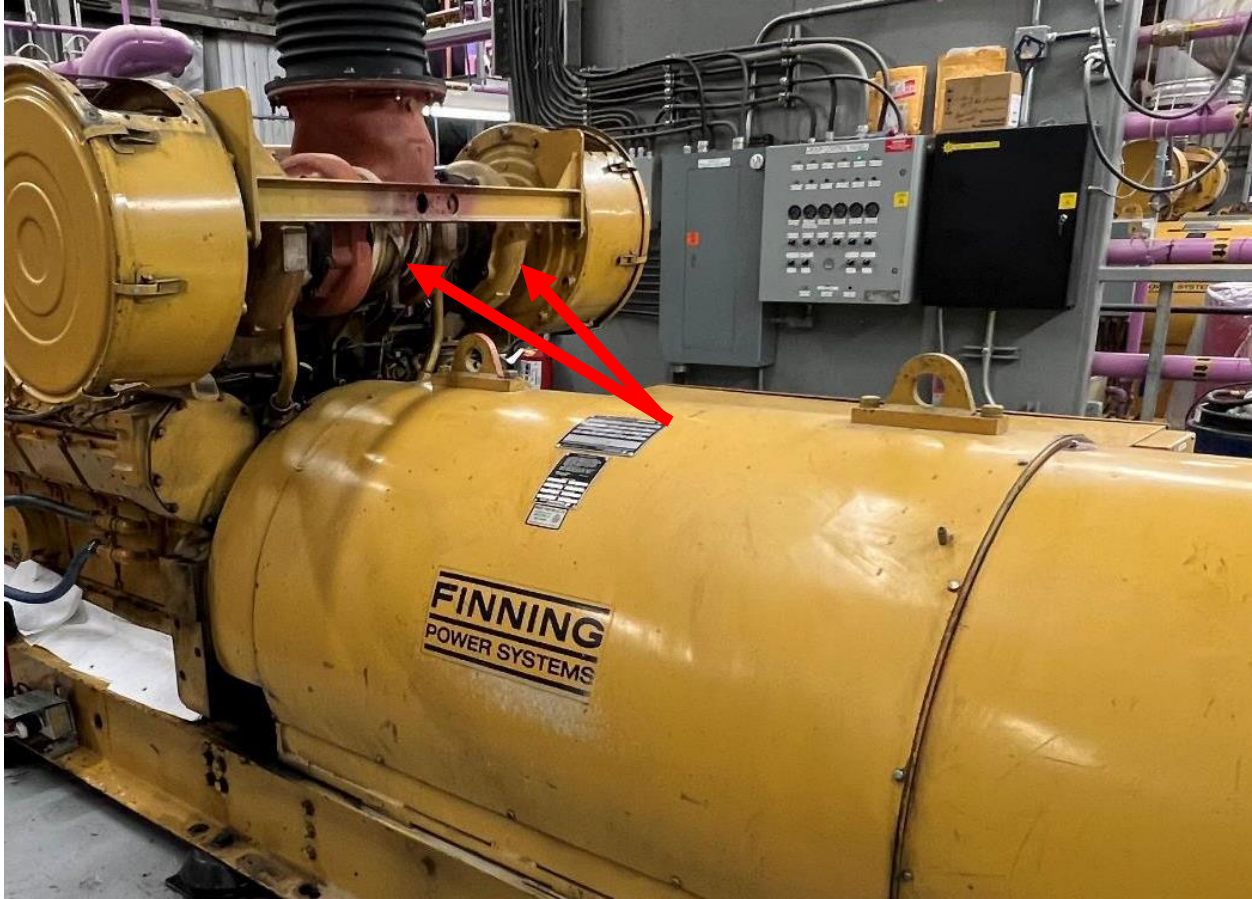
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**Finding #6 – Generator Skid – Isolation pads aren't secure to the concrete floor.**



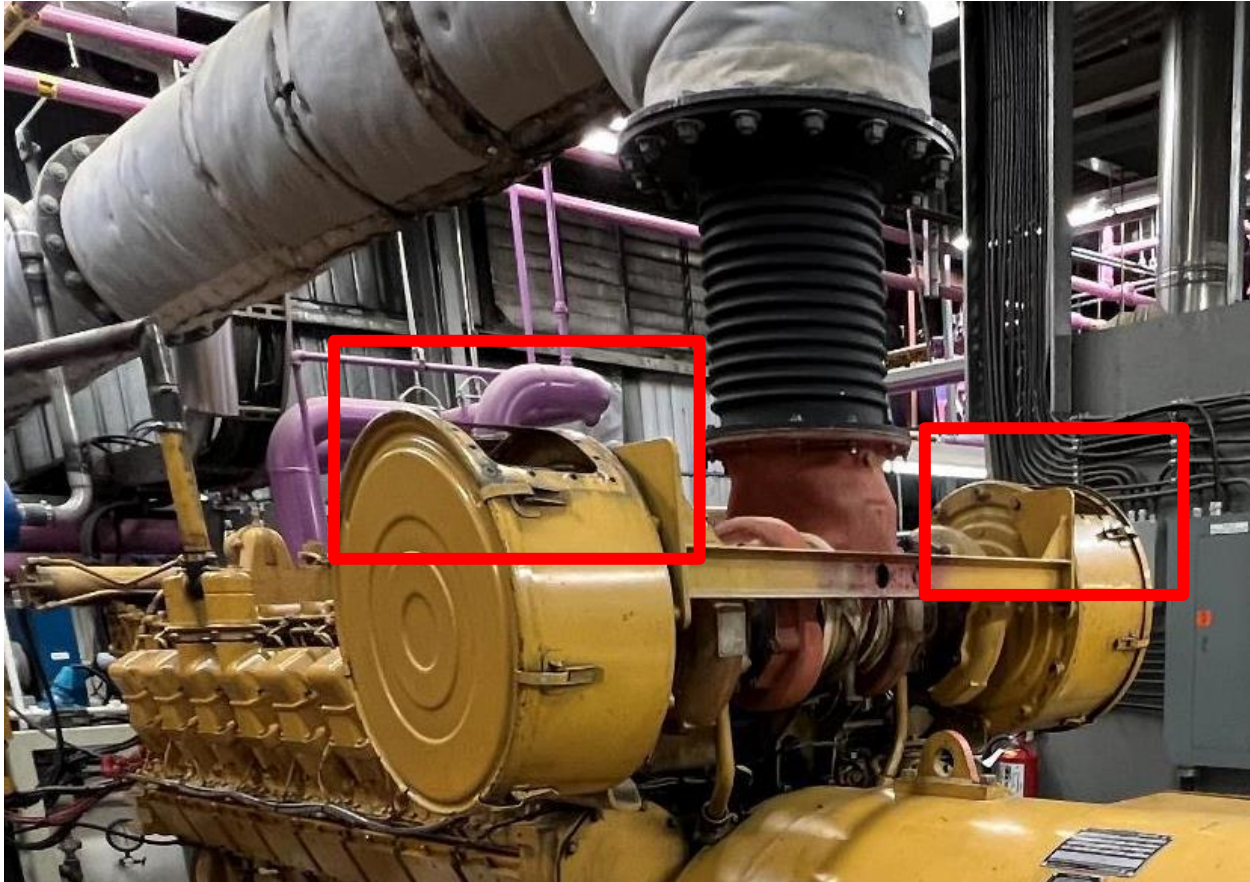
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**Finding #7 – Engine, Exhaust – Leak on turbo exhaust.**



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**Finding #8 – Engine, Air Intake** – Air filter housing had the opening upwards pulling in hot exhaust air.



## Collicutt Energy / Yukon Energy – Dawson – DD4 – Cat 3516 SN: 25Z01988

### Conclusion and Recommendations:

After inspecting and testing generator DD4 we conclude several repairs and improvement items to be completed. Due to the unit approaching the 24,000 hr overhaul marker, we recommend completing this overhaul in the near future.

During testing the techs were able to achieve the target load levels without experiencing an oil temp limit issue. The onsite operators did note, the cooler had recently been cleaned.

### Immediate Recommendations

- Rotate the air intake canisters to point away from the exhaust
- Complete 24,000 hr overhaul as soon as achievable
- Verify coolant age and last cooler flush – replace and complete flush if over 5 years

### Medium Level Recommendations

- Secure isolation pads to cement once overhaul is completed
- Repeat conditional monitoring after overhaul and repairs completed – set a new base line
  - o Repeat testing every 2,000 to 3,000 operating hours
- 1,000 hr or annual oil sample analysis
- Continue routine cooler maintenance and cleaning
- Add vibration shut down switches – this can be installed on the engine / gen during the overhaul and connected to controller during commissioning

## **YEC 2023/24 GRA**

**Exhibit # \_\_\_\_\_**

### **Undertaking #43**

- March 7, 2024 Transcript, page 577, lines 10-11: To confirm the details of changing the nameplate capacity on DD1.

### **YEC Response:**

The correct nameplate capacity of DD1 is in fact 800 kW, as indicated in NY-YEC-1-2 REVISED Attachment 1 (Exhibit 4, PDF page 4), and has not changed.

On review, YEC has verified that Mr. Murchison's statements in the March 7, 2024 Transcript (pages 461 and 574-575) that the nameplate capacity of DD1 was 1,000 kW were mistaken, and should be corrected as noted above.

The response to NY-YEC-1-2(a) REVISED (Exhibit 4, PDF pages 2-3) explains the changes in the dependable capacity of DD1 and other existing diesel units based on test runs that Operations staff performed in 2022. Based on those test runs, the DD1 max load achieved was set at 850 kW with overload capability (exceeding the unit's nameplate capacity).

# **Attachment 3**

### YEC 2023/24 GRA Undertakings Cover Letter Attachment 3

#### List of Corrections to the Hearing Transcripts

Transcript Reference	Correction
March 5, 2027, Volume 2, page 213, line 22 "KJS"	This should be corrected as "KGS"
March 6, 2027, Volume 3, page 367, line 6 "planning and <u>visibility</u> studies"	This should be corrected as "planning and <u>feasibility</u> studies"
March 7, 2024, Volume 4, page 566, lines 9 – 12: "To confirm that line 355 serves the village of Haines Junction and check the number of customers affected by the August 3rd outage."	This should be corrected as "To confirm that line 355 serves the village of Haines Junction and check the number of customers affected by the August 20, 2023 outage."
March 7, 2027, Volume 4, page 569, line 6 "Exhibit 17 – Aid to Cross Number 3"	This should be corrected as "Exhibit 17 – Outage/Disturbance Report August 2023"
March 7, 2027, Volume 4, page 582, lines 22-23 "Exhibit 21 – Mr. Yee's Aid to Cross, pages 16 to 23"	This should be corrected as "Exhibit 21 – Mr. Yee's Aid to Cross, pages 15 to 23"