

**Startup, Shutdown, & Malfunction Plan (SSMP)  
and  
Malfunction Abatement Plan (MAP)  
and  
Site Specific Monitoring Plan**

**for**

**Gas-Fired Reciprocating Internal Combustion Engines  
and Oxidation Catalysts**

**located at**

**Washington 10 Natural Gas Compressor Station (SRN N3391)  
12700 30 Mile Road  
Washington Township, Macomb, MI 48095**

June 29, 2020

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**FOR REFERENCE ONLY**

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## 1 Plan Overview

A Startup, Shutdown, and Malfunction Plan (“SSMP”) and a Malfunction Abatement Plan (“MAP”) are required by the Renewal Operating Permit (“ROP”) for the Washington 10 Compressor Station (the “Station”), SRN# N3391, for the site’s three natural gas-fired reciprocating internal combustion engines and the associated oxidation catalyst systems. The SSMP and MAP have been combined into this one document which shall be referred to as the “Plan”. The Plan addresses the required SSMP elements as specified by 40 CFR 63 Subpart ZZZZ, including the general SSMP requirements of 40 CFR 63 Subpart A which are applicable to the Station pursuant to Table 8 of Subpart ZZZZ (Appendix D of this Plan). The Plan also covers the MAP requirements of Michigan State Air Rules 911 and 912.

The purpose of this Plan is to describe the specific procedures to be followed should a problem or malfunction occur during the start-up, operation, and shutdown of the affected equipment. The Plan will ensure the equipment is operated in a manner consistent with safety and good air pollution control practices to minimize air pollution emissions at all times and ensure that malfunctions are corrected as soon as practicable in order to minimize emissions. The Plan is also used to describe the documentation, notification, and reporting requirements when an SSMP or MAP event occurs. Finally, the Plan addresses the requirements for a written quality control protocol for the thermocouples (CMS), this part of the Plan will be addressed in Appendix D.

A hard copy of the current Plan is available at the Station and is also stored electronically in Environmental Management & Resources’ (EM&R’s) SharePoint. Prior versions of the Plan must be maintained for a period of five years and are available in SharePoint. A copy of the Plan must be made available to the Environment, Great Lakes, and Energy (“EGLE”) upon request.

The Station Manager, or their designee, is responsible for assuring that the most recent copy of the Plan is made available to personnel involved with the site’s operation and engine maintenance. This includes ensuring that the necessary employees are aware and trained in the procedures and requirements contained in the Plan. They are also responsible to assure that appropriate actions are taken as identified in the Plan and initiating necessary corrective actions to address any procedural failures.

## 2 Supervisory Personnel

Primary Contact (designee): Joe Kotwicki, Supervisor, Transmission and Storage Operations

Secondary Contact: Ben Parrotta, Washington 10 Station Manager

## 3 Equipment

The Plan covers the Washington-10 site’s three natural gas fired reciprocating internal combustion engines and the associated oxidation catalyst systems. Specifically, the equipment includes:

- Three 4,735 hp, 4-stroke lean-burn engines (“4SLB”) equipped with oxidation catalyst;
- Differential pressure instrumentation to measure the pressure drop across each catalyst;

- A Continuous Parameter Monitoring system (“CPMS”) for measuring the inlet temperature to each oxidation catalyst, consisting of a thermocouple for each catalyst and a common data acquisition system (CPMS-T).

## 4 Equipment Inspection and Frequency

Routine monitoring, inspection and maintenance routines are performed as follows:

- Engines – Operating rounds are performed during each shift that the engines are in operation to check for leaks and look for any unusual operating conditions. The oil is checked monthly to detect maintenance problems that might be developing. Routine engine maintenance is performed at manufacturer recommended intervals (2000/5000/10K/20K/50K hr operating maintenance) and typically covers bearings, powerheads, combustion, etc. (see Appendix C for routine maintenance schedule). The engines are equipped by the manufacturer with controls that automatically shut down the engine if it should operate outside its normal operating ranges or otherwise malfunction.
- Catalyst –Pressure differential across the catalyst and the catalyst inlet temperature are monitored continuously when the associated engine is operating (see **Table 1** for actionable ranges). Catalyst is typically washed prior to stack testing. The catalyst is replaced based on manufacturer’s recommendations or if the catalyst was determined to be a factor in a stack test failure.
- Catalyst Inlet Thermocouple – Accuracy of the thermocouple for each catalyst inlet is checked once each calendar year and, if necessary, the thermocouple is replaced. Thermocouple accuracy must be within 1% of measured value or 2.8°C (5°F), whichever is higher.

Miscellaneous instrumentation components are maintained in stock at the site. Engine and catalyst replacement parts are not kept in site inventory but are readily available from the manufacturer or other suppliers.

## 5 Events Covered by the Plan

The Plan will be implemented whenever an abnormal event occurs. An abnormal event for the purposes of the Plan is any startup of an engine that does not follow the automated or manual procedures, does not reach or maintain acceptable catalyst conditions, and any malfunction of the equipment covered by this Plan as identified in **Table 1**.

**Table 1** lists the potential events and the actions to be taken. All events, except catalyst replacement, must be fully documented by completion of the Startup, Shutdown and Malfunction Event or Report form in **Appendix A**. The Event form (A-1) is completed when the actions outlined in the Plan are successfully followed. The Report form (A-2) is completed when the actions outlined in the Plan are not successfully followed or the abnormal event that occurred is not identified in **Table 1**. The operators must complete the applicable form and notify the personnel identified on the form of the occurrence of the event within the time noted at the bottom of the form. Times recorded on either form must be the same as the time in the CPMS-T data acquisition system. When filling out either form, check the CPMS-T data to ensure the times are accurately recorded and the same.

## 6 Plan Requirements and Revisions

The Plan requirements are listed below for actions that are consistent with the Plan, actions that are inconsistent with the Plan, and events that are not covered by the Plan. Documentation for each abnormal event should be completed using the appropriate form(s) in **Appendix A** and after completion saved in **Appendix B**.

Revisions to the Plan are required if the process operations or procedures change, an event occurs that is not in the Plan, the procedures do not minimize emissions during an event, or the procedures do not correct malfunctions as quickly as practical.

Copies of all Plan revisions and completed forms and checklists must be maintained for a period of five years.

### 6.1 Abnormal Event Identified in the Plan Occurs and Actions taken are Consistent with the Plan

Operators use the Event Form (A-1) to:

- Record time, date, and duration of the event
- Record a description of the event (if a malfunction)
- Record corrective actions taken during the event

DTM Environmental Representative

- Assess whether any ROP operating limits were exceeded during the event. If operating limits were exceeded, verify the written description of the actions taken on the event form are complete and accurate, attach a note listing which operating limits were exceeded, and include the reasoning as to why the actions taken during the event resulted in minimizing emissions.
- The completed Abnormal Event Form shall be stored in **Appendix B** and included in the next ROP certification, as applicable

### 6.2 Abnormal Event Identified in the Plan Occurs and Actions taken are Inconsistent with the Plan

Operators use the Report Form (A-2) to:

- Record time, date, and duration of the event
- Record the cause of the event
- Record corrective actions taken during the event
- Record the reason for taking the described actions during the event
- Record why the Plan was not followed
- Submit the Report to the DTM Environmental Representative within 24 hours of the event.  
**Note:** Timing is important because the report must be reviewed and verified before reporting to EGLE within a two-day limit.

DTM Environmental representative

- Assess whether any ROP operating limits were exceeded during the event. If operating limits were exceeded, verify the written description of the actions taken on the event form are complete and accurate, attach a note listing which operating limits were exceeded, and include the reasoning as to why the actions taken during the event resulted in minimizing emissions.
- Review the Report and report it to the AQD district supervisor at the applicable EGLE district office via phone or fax report within two days of the event.
- Submit a written report to the AQD district supervisor within seven days of the event – The report must include: the actions taken during the event, a description of the event, a description of all excess emissions and/or parameter monitoring exceedances that are believed to have occurred, name, title, and signature of owner/operator or other responsible official who is certifying accuracy of the Reports.
- Review the Plan procedures to determine if the Plan should be revised. If revisions to the Plan are required, the revisions must be completed within 45 days of the malfunction event.
- The completed Abnormal Report Form shall be stored in **Appendix B** and included in the next ROP certification, as applicable

### 6.3 Abnormal Event Occurs that is Not Covered by the Plan

Operators use the Report Form (A-2) to:

- Record time, date, and duration of the event
- Record the cause of the event
- Record corrective actions taken during the event
- Record the reason for taking the described actions during the event
- Record why the Plan was not followed
- Submit Report to the DTM Environmental Representative within 24 hours of the event.

**Note:**

Timing is important because the report must be reviewed and verified before reporting to EGLE within a two-day limit.

DTM Environmental Representative

- Review the Report and report it to the AQD district supervisor at the applicable EGLE district office via phone or fax within two days of the event.
- Revise the Plan within forty-five days after the abnormal event to include the abnormal event.
- The completed Abnormal Report Form shall be stored in **Appendix B** and included in the next ROP certification, as applicable

### 6.4 Plan Revisions

- There is no time requirement on Plan revisions unless the revision is required due to an event that occurred and was not in the original Plan or an event that occurred and the current procedure was inadequate. Revisions for inadequate or omitted procedures must be completed within 45 days.
- If the Plan is revised, it will not take effect until after a written notice describing the revision is provided to the applicable EGLE district office. At a minimum, revisions of the Plan must be reported in the next Report, which is submitted with the next ROP Compliance Certification Report. Revisions to the Plan are not considered revisions to the Title V permit.

**Table 1  
Startup, Shutdown and Malfunctions Events**

WASHINGTON 10 COMPRESSOR STATION

Abnormal Event		Response
<b>Caterpillar Engines (Units 4-6)</b>		
<p><b>START-UP:</b> Successful start-up operation is considered the following: Engine startup is initiated, and the catalyst attains satisfactory operating temperature within thirty (30) minutes or less. Satisfactory operating temperature is between 450°F and 950°F.</p>	<p><b>Abnormal Start-Up Event includes the following:</b></p> <ul style="list-style-type: none"> <li>• Engine stops before obtaining full operation and does not follow a successful shutdown procedure, or</li> <li>• Engine operates for more than 30 minutes without reaching satisfactory catalyst inlet operating between 450°F and 950°F.</li> </ul>	<ul style="list-style-type: none"> <li>• Shut down engine and determine cause of problem</li> <li>• Notify Environmental Representative of potential problem</li> <li>• Operator documents the event using the applicable Startup, Shutdown and Malfunction Event or Report form in Appendix A if the shutdown took more than 30 minutes or if the engine operated for more than 30 minutes without reaching satisfactory catalyst inlet operating temperature.</li> </ul>
<p><b>SHUTDOWN:</b> Successful shutdown operation is considered the following: Engine shutdown is initiated, and engine stops within 30 minutes or less.</p>	<p><b>Abnormal Shutdown Event includes the following:</b></p> <ul style="list-style-type: none"> <li>• Engine does not respond to shut down procedure,</li> <li>or</li> <li>• Engine operates for more than 30 minutes after engine shutdown procedure has been initiated.</li> </ul>	<ul style="list-style-type: none"> <li>• Cutoff gas to engine and determine cause of problem</li> <li>• Notify Environmental Representative of potential problem within 12 hours</li> <li>• Operator documents the event using the applicable Startup, Shutdown and Malfunction Event or Report form in Appendix A if the shutdown took more than 30 minutes.</li> </ul>
<p><b>MALFUNCTION:</b> A malfunction is an abnormal operating condition that was not initiated through processes and is outside of the Operator's control.  <b>Note:</b> Automatic control responses to malfunctions that occur as designed by the manufacturer are not abnormal events for environmental purposes unless excess emissions occur as a result.</p>	<ul style="list-style-type: none"> <li>• Control Room alarm for engine shutdown sounds and automatic shutdown does not occur,</li> <li>or</li> <li>• fire, lightening, weather, and other Acts of God causes engine to operate outside the normal operating ranges and the engine does not automatically shut down.</li> </ul>	<ul style="list-style-type: none"> <li>• If the malfunction does not result in engine shutdown, determine the cause of the malfunction using the Control Panel or the Operators Manual located in the Control Room to diagnose the malfunction and identify the appropriate corrective action.</li> <li>• If there is a potential for excess emissions, immediately call the Environmental Representative to determine if the engine should be shut down for environmental purposes.</li> <li>• Operator documents the event using the applicable Startup, Shutdown and Malfunction Event or Report form in Appendix A if the shutdown took more than 30 minutes.</li> </ul>

**Table 1  
Startup, Shutdown and Malfunctions Events**

WASHINGTON 10 COMPRESSOR STATION

	Abnormal Event	Response																				
<b>Catalyst System</b>																						
<p><b>Catalyst Installation and Removal:</b> Although this is not an abnormal event, it is included in this table to document all catalyst change-outs.</p>	<p>Catalyst change-out is required based on manufacturer's guidelines or if determined to be a factor in a stack test failure.</p>	<ul style="list-style-type: none"> <li>Follow the catalyst change-out procedure</li> <li>Call Environment Representative and let them know the catalyst has been changed so they can arrange to have a performance test conducted within the required 180 days.</li> </ul>																				
<p><b>Pressure Drop Outside Operating Range</b>            Note: This does not include catalyst pressure drop during normal startup and shut down of the engine (first 30 minutes after startup).             After reaching normal operating levels, pressure drop across the catalyst must be within allowable pressure drop range established during the performance test. (Permit allows a maximum variation of <math>\pm 2</math> in wg from the test value.)</p>	<p>Pressure drop across the catalyst is not within allowable upper and lower permit limits established during the performance test and the associated engine is not shutting down successfully.</p>	<ul style="list-style-type: none"> <li>Operator tries to shut down the engine in a successful manner (within 30 minutes of start of event)</li> <li>Notify Environmental Representative of potential problem within 12 hours</li> <li>Operator documents the event using the applicable Startup, Shutdown and Malfunction Event or Report form in Appendix A if the shutdown took more than 30 minutes.</li> </ul>																				
<p><b>Lower Limits:</b> The average pressure drops determined during the performance test and the low pressure drop limits are:</p> <table border="1" data-bbox="986 1227 1114 1944"> <thead> <tr> <th>Unit</th> <th>Test Value</th> <th>Lower permit limit</th> <th>Alarm</th> <th>Automatic shutdown</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>2.6 in wg</td> <td>0.6 in wg</td> <td>1.0 in wg</td> <td>0.7 in wg</td> </tr> <tr> <td>5</td> <td>2.9 in wg</td> <td>0.9 in wg</td> <td>1.3 in wg</td> <td>1.0 in wg</td> </tr> <tr> <td>6</td> <td>1.4 in wg</td> <td>0.1 in wg*</td> <td>0.4 in wg</td> <td>0.15 in wg</td> </tr> </tbody> </table> <p>* Lower allowable permit limit established for Unit 6.</p>	Unit	Test Value	Lower permit limit	Alarm	Automatic shutdown	4	2.6 in wg	0.6 in wg	1.0 in wg	0.7 in wg	5	2.9 in wg	0.9 in wg	1.3 in wg	1.0 in wg	6	1.4 in wg	0.1 in wg*	0.4 in wg	0.15 in wg		
Unit	Test Value	Lower permit limit	Alarm	Automatic shutdown																		
4	2.6 in wg	0.6 in wg	1.0 in wg	0.7 in wg																		
5	2.9 in wg	0.9 in wg	1.3 in wg	1.0 in wg																		
6	1.4 in wg	0.1 in wg*	0.4 in wg	0.15 in wg																		
<p><b>Upper Limits:</b> The average pressure drops determined during the performance test and the high pressure drop limits are:</p> <table border="1" data-bbox="1241 1227 1369 1944"> <thead> <tr> <th>Unit</th> <th>Test Value</th> <th>Upper permit limit</th> <th>Alarm</th> <th>Automatic shutdown</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>2.6 in wg</td> <td>4.6 in wg</td> <td>3.8 in wg</td> <td>4.1 in wg</td> </tr> <tr> <td>5</td> <td>2.9 in wg</td> <td>4.9 in wg</td> <td>4.1 in wg</td> <td>4.4 in wg</td> </tr> <tr> <td>6</td> <td>1.4 in wg</td> <td>3.4 in wg</td> <td>2.8 in wg</td> <td>3.1 in wg</td> </tr> </tbody> </table>	Unit	Test Value	Upper permit limit	Alarm	Automatic shutdown	4	2.6 in wg	4.6 in wg	3.8 in wg	4.1 in wg	5	2.9 in wg	4.9 in wg	4.1 in wg	4.4 in wg	6	1.4 in wg	3.4 in wg	2.8 in wg	3.1 in wg		
Unit	Test Value	Upper permit limit	Alarm	Automatic shutdown																		
4	2.6 in wg	4.6 in wg	3.8 in wg	4.1 in wg																		
5	2.9 in wg	4.9 in wg	4.1 in wg	4.4 in wg																		
6	1.4 in wg	3.4 in wg	2.8 in wg	3.1 in wg																		



**Table 1  
Startup, Shutdown and Malfunctions Events**

WASHINGTON 10 COMPRESSOR STATION

	Abnormal Event	Response
<b>Catalyst System (continued)</b>		
<p><b>Temperature Outside Operating Range</b>                      Note: This does not include catalyst temperature during normal startup and shut down of the engine (first 30 minutes after startup).                       The lower temperature limit in the Permit is 450°F. System is set to alarm at 700°F and automatically shut down at 650°F.                       The upper temperature limit in the Permit is 1350°F. System is set to alarm at 900°F and automatically shut down at 950°F.</p>	<ul style="list-style-type: none"> <li>Temperature of the inlet gas to the catalyst is outside the operating temperature range (650°F-950°F) and the associated engine is not shutting down successfully.</li> </ul>	<ul style="list-style-type: none"> <li>Operator tries to shut down the engine in a successful manner (within 30 minutes of start of event)</li> <li>Notify Environmental Representative of potential problem within 12 hours.</li> <li>Operator documents the event using the applicable Startup, Shutdown and Malfunction Event or Report form in Appendix A if the shutdown took more than 30 minutes.</li> </ul>
<p><b>Malfunction:</b> A malfunction is an abnormal operating condition that was not initiated through processes and is outside of the Operator's control   <b>Note:</b> Automatic control responses to malfunctions that occur as designed by the manufacturer are not abnormal events for environmental purposes unless excess emissions occur as a result.</p>	<ul style="list-style-type: none"> <li>Control Room alarm for engine shutdown will sound and automatic shutdown does not occur,</li> <li>or</li> <li>fire, lightning, weather, and other Acts of God causes engine to operate outside the normal operating ranges and the engine does not automatically shut down.</li> </ul>	<ul style="list-style-type: none"> <li>If the malfunction does not result in engine shutdown, determine the cause of the malfunction using the Control Panel or the Operators Manual located in the Control Room to diagnose the malfunction and identify the appropriate corrective action.</li> <li>If there is a potential for excess emissions, immediately call the Environmental Representative to determine if the engine should be shut down for environmental purposes.</li> <li>Operator documents the event using the applicable Startup, Shutdown and Malfunction Event or Report form in Appendix A if the shutdown took more than 30 minutes.</li> </ul>

## APPENDIX A BLANK FORMS

- **Form A-1:** Startup, Shutdown and Malfunction Event Form is completed when the actions outlined in the Plan are successfully followed.
- **Form A-2:** Startup, Shutdown and Malfunction Report Form is completed when the actions outlined in the Plan are not successfully followed or the abnormal event that occurred is not identified in **Table 1**.
- **Form A-3:** Thermocouple Calibration Form is completed annually when thermocouple accuracy check is conducted on each affected unit.

# STARTUP, SHUTDOWN, AND MALFUNCTION EVENT FORM

To be completed for each Event that followed the actions noted in the Plan

Must be retained for a minimum period of five (5) years

Completed by \_\_\_\_\_

Completion Date \_\_\_\_\_

Facility Name: \_\_\_\_\_

Facility Address: \_\_\_\_\_

Type of event (circle one)

Startup

Shutdown

Malfunction (describe) \_\_\_\_\_

Time/Duration of Event:

Start Date & Time of Event: \_\_\_\_\_

End Date & Time of Event: \_\_\_\_\_

Duration of Event: \_\_\_\_\_

What steps were taken to immediately correct event?(circle one)

Yes

No

What steps were taken to minimize emissions from event?(circle one)

Yes

No

Were monitoring and control systems in operation during event?(circle one)

Yes

No

Were actions taken consistent with Plan? (circle one)

Yes

No

If No, describe corrective actions taken during event and complete SSM Report Form:

Did Plan provide adequate procedures to address event? (circle one)

Yes

No

If NO, provide recommendations for revision to Plan

Was an evaluation of root cause of event made? (circle one)

Yes

No

If yes, results of evaluation

If NO, reason for not performing evaluation

**\* IF YOU ANSWERED NO TO ANY OF THE QUESTIONS ON THIS FORM,  
NOTIFY DTM ENVIRONMENTAL CONTACT IMMEDIATELY.**

# STARTUP, SHUTDOWN, AND MALFUNCTION REPORT FORM

To be completed for each Event that followed the actions noted in the Plan

Must be retained for a minimum period of five (5) years

Facility Name: \_\_\_\_\_

Facility Address: \_\_\_\_\_

Reason for using this form (circle one)

- Actions taken during event were inconsistent with Plan
- Event is not addressed in Plan

Affected Equipment: (circle one)

- Engine
- Catalyst
- Temperature CPMS
- Pressure Drop CPMS
- Other - describe:

Start Date & Time of Event: \_\_\_\_\_

End Date & Time of Event: \_\_\_\_\_

Duration of Event: \_\_\_\_\_

Describe cause of event: \_\_\_\_\_

\_\_\_\_\_

Describe corrective actions taken during event: \_\_\_\_\_

\_\_\_\_\_

Describe reasons for taking these corrective actions during event: \_\_\_\_\_

\_\_\_\_\_

Were any units shutdown due to event? (circle one)      Yes      No

Name: \_\_\_\_\_

Title: \_\_\_\_\_

**GIVE COMPLETED FORM TO DTM ENVIRONMENTAL CONTACT  
WITHIN 12 HOURS OF EVENT**

# THERMOCOUPLE CALIBRATION REPORT

**STATION:** Belle River Mills      Columbus      W10      Alpena      Willow

**Unit:** Refrigeration Plant      Dehy      Engine Catalyst Inlet

Engine Name/No: \_\_\_\_\_

Calibration Data (include unit of measure, °F or °C):

	1 <sup>st</sup> Measurement	2 <sup>nd</sup> Measurement	3 <sup>rd</sup> Measurement
Input Value			
Output Value			
Accuracy			

Refrigeration Plant – no accuracy required, but must calibrate

BRM Dehy – accuracy must be within 2% of measured value or 2.5°C (4.5°F) whichever is higher

Engine Catalyst Input – accuracy must be within 1% of measured value or 2.8°C (5°F) whichever is higher

**STATION:** Belle River Mills      Columbus      W10      Alpena      Willow

**Unit:** Refrigeration Plant      Dehy      Engine Catalyst Inlet

Engine No: \_\_\_\_\_

Calibration Data (include unit of measure, °F or °C):

	1 <sup>st</sup> Measurement	2 <sup>nd</sup> Measurement	3 <sup>rd</sup> Measurement
Input Value			
Output Value			
Accuracy			

Refrigeration Plant – no accuracy required, but must calibrate

BRM Dehy – accuracy must be within 2% of measured value or 2.5°C (4.5°F) whichever is higher

Engine Catalyst Input – accuracy must be within 1% of measured value or 2.8°C (5°F) whichever is higher

Comments: \_\_\_\_\_

Signature \_\_\_\_\_

Date: \_\_\_\_\_

Title: \_\_\_\_\_

**APPENDIX B**  
**COMPLETED FORMS**  
(forms to be kept a minimum of 5 years from date of completion)

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**APPENDIX C**  
**Routine Maintenance Schedule**

# Caterpillar Maintenance

<b>Unit 4,5,6 2000 hour Maintenance</b>	
Drain aftercooler condensation	Maintenance done by Archrock
Inspect crankshaft vibration damper	Maintenance done by Archrock
Clean engine crankcase breather	Maintenance done by Archrock
Check engine mounts	Maintenance done by Archrock
Inspect/Adjust engine valve lash	Maintenance done by Archrock
Inspect engine valve rotators	Maintenance done by Archrock
Measure and record valve stem projection	Maintenance done by Archrock
Coolant Sample	Maintenance done by Archrock
Lubricate acuator control lingage	Maintenance done by Archrock
Exercise Unit- Take Oil Sample - note Hours	Maintenance done by Archrock
Hose and clamps - inspect/replace	Maintenance done by Archrock
Check air intake filters and pre-filters for degradation. Change as necessary.	Maintenance done by Archrock
Ignition system spark plugs - check/adjust	Maintenance done by Archrock

<b>Unit 4,5,6 5000 hour Maintenance</b>	
Clean starting air motor lines' screens	Maintenance done by Archrock
Clean starting air motor lubrication bowl	Maintenance done by Archrock
Clean/Inspect/Replace Combustion Sensor	Maintenance done by Archrock
Inspect cooling system level switch	Maintenance done by Archrock
Measure/Record crankcase blowby	Maintenance done by Archrock
Pressurize and record cylinder pressure	Maintenance done by Archrock
Check electrohydraulic system and adjust as necessary	Maintenance done by Archrock
Change electrohydraulic system oil	Maintenance done by Archrock
Change electrohydraulic system oil filter	Maintenance done by Archrock
Change engine oil filter	Maintenance done by Archrock
Check engine protective devices and inspect engine protective device connections	Maintenance done by Archrock
Recondition exhaust bypass	Maintenance done by Archrock
Inspect gas shutoff valve	Maintenance done by Archrock
Replace ignition system spark plugs	Maintenance done by Archrock
Inspect inlet air system	Maintenance done by Archrock
Inspect inlet gas manifold and piping and replace as necessary	Maintenance done by Archrock
Clean prechamber check valves	Maintenance done by Archrock
Inspect starting motor	Maintenance done by Archrock



Inspect turbocharger	Maintenance done by Archrock
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<b>Unit 4,5,6 10,000 hour Maintenance</b>	
Gas Admission Valve seals Inspect/Replace	Maintenance done by Archrock
Cooling System Water Regulator /Replace	Maintenance done by Archrock
Electrohydraulic Actuator - inspec	Maintenance done by Archrock
Engine Oil Temp Regulator /Replace	Maintenance done by Archrock
Engine Speed Sensor Clean/iNspec	Maintenance done by Archrock
Exhaust Shields Inspect	Maintenance done by Archrock
Gas Pressure Regulator /Inspect	Maintenance done by Archrock
prelube pump- inspect	Maintenance done by Archrock
Water Pump - inspect	Maintenance done by Archrock

<b>Unit 4,5,6 20,000 hour Maintenance</b>	
Change Coolant	Done by DTM

<b>Unit 4,5,6 50,000 hour Maintenance</b>	
Recondition Electrohydraulic actuator	Maintenance done by Archrock
Recondition Gas Admissin Valve	Maintenance done by Archrock
In-Frame Overhaul	Maintenance done by Archrock

**APPENDIX D**  
**Site Specific Monitoring Plan**

**required by ROP Condition FGENGINES2 IV.2.a**  
**(40 CFR 63.8(d) & 40 CFR 63.6625(b))**

**FOR REFERENCE ONLY**

## Site Specific Monitoring Plan

Washington 10 Compressor Station required under Table 8 of Subpart ZZZZ; (40 CFR 63.8(d)) to provide a written protocol that describes procedures for each of the following operations (listed below).

### 40 CFR 63.8(d):

#### (i) Initial and any subsequent calibration of CMS:

Each CMS (thermocouple) has an accuracy check performed on it 1 time a year as defined in this Plan (Washington 10 SSMP and MAP) Section 4. PM's are created in the Maximo work order system. PM's for performing the accuracy check on the thermocouples include the manufacture's step by step instruction on how to perform accuracy check.

#### (ii) Determination and adjustment of the calibration drift of the CMS (thermocouple):

There are no adjustments made to the thermocouple. If thermocouple fails annual accuracy check the thermocouple is replaced with a new thermocouple.

#### (iii) Preventive maintenance of the CMS (thermocouple), including spare parts inventory

This is defined in this Plan Section 4.

#### (iv) Data recording, calculation, and reporting

Data measurement is done through an Allen Bradley Control Logix PLC system. The data is archived by the PI system at Washington 10 (archiving system OSISoft). From here temperature data is uploaded into Excel where calculations are completed to compile the temperature data (from the thermocouples) into 4 hour rolling averages as prescribed in the Stations ROP (FGENGINES2 VI.2 & 8)

Data is collected every 15 minutes with the engine is running. The 4 hour rolling averages comprise of the current block hour as well as the previous 3 block hours (if the engine wasn't operating in the consecutive 3 block hours the system will calculate the 4-hour rolling average from the last 3 block hours the engine was in operation). A block hour will consist of the average readings from 4-15-minute reading taken within a full hour (i.e. 00:00:00 – 00:59:59). If the engine operating during a partial hour (either starts up or shuts down without having 4 readings) the average for the block hour will be take over the number of readings that were taken (i.e. 2 or 3 reading verses 4 reading).

#### (v) Accuracy audit procedures, including sampling and analysis methods; and

To conduct the accuracy audits (annual accuracy checks) personnel at Washington 10 follow thermocouple manufacture's recommendation.

#### (vi) Program of corrective action for a malfunction CMS (thermocouple)

This is defined in this Plan Section 5 and Table 1.

In addition to the information above the Site is also required to prepare a program (not required to be written) which includes the following (from 40 CFR 63.6625(b) as written in ROP condition FGENGINES2 IV.2.a (NOTE: Much of the below requirements have been captured in the above requirements under 40 CFR 63.8(d))

**i. The performance criteria and design specifications for the monitoring system equipment including the sample interface, detector signal analyzer and data acquisition and calculations**

The sample interface (thermocouples) currently in use are as follows:

Unit 4: Rosemount Thermocouple – Model 0183R23J2N00909E5

Unit 5: Rosemount Thermocouple – Model 0183R23J2N00A060T34E6

Unit 6: Rosemount Thermocouple – Model 0183R23J2N00A060T34E6

The data accusation system has been described above under 40 CFR 63.8(iv)

**ii. Sample interface (thermocouple) location such that the monitoring system will provide representative measurement**

Locations of the thermocouples in each exhaust stack for Units 4-6 are located in Appendix D, Figures of this Plan.

**iii. Equipment performance evaluations, system accuracy audits, or other audit procedures:**

This has been defined above under 40 CFR 63.8(d)(i)

**iv. Initial and any subsequent calibration of the CMS**

This has been defined above under 40 CFR 63.8(d)(i)

**v. Determination and adjustment of the calibration drift of the CMS**

This has been defined above under 40 CFR 63.8(d)(ii)

**vi. Preventive maintenance of the CMS, including spare parts inventory**

This has been defined above under 40 CFR 63.8(d)(i)

**vii. Data recording, calculations, and reporting**

This has been defined above under 40 CFR 63.8(d)(iv)

**viii. Accuracy audit procedures, including sampling and analysis methods**

This has been defined above under 40 CFR 63.8(d)(v)

**ix. Programs of Corrective action for a malfunction CMS**

This has been defined above under 40 CFR 63.8(d)(vi)

**x. Conduct performance evaluations as described in 40 CFR 63.8(e)**

If requested (under 40 CFR 63.8(d)) the Station will develop and submit to the Administrator for approval upon request a site-specific performance evaluation test plan for the CMS performance evaluation required in paragraph (e)(3)(i) of this

section, according to the procedures specified in paragraph (e). At this time the Administrator has not requested a test plan for the thermocouple accuracy audits/test.

**xi. Keeping the necessary parts for routine repairs of the affected CPMS equipment readily available**

This has been defined above under 40 CFR 63.8(d)(iii)

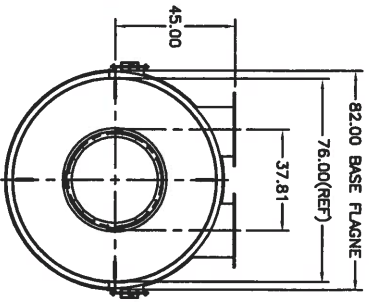
**xii. Verification of operational status that includes, at a minimum, completion of the manufacturer's written specification or recommendations for installation, operation and calibration of the system**

Annual accuracy audits of the thermocouples are conducted as described in this Plan under Section 4. A PM is generated on an annual basis for Station personnel to conduct the accuracy audit and a form (Form A-3) is filled out by Station personnel. These forms are filed with the Station.

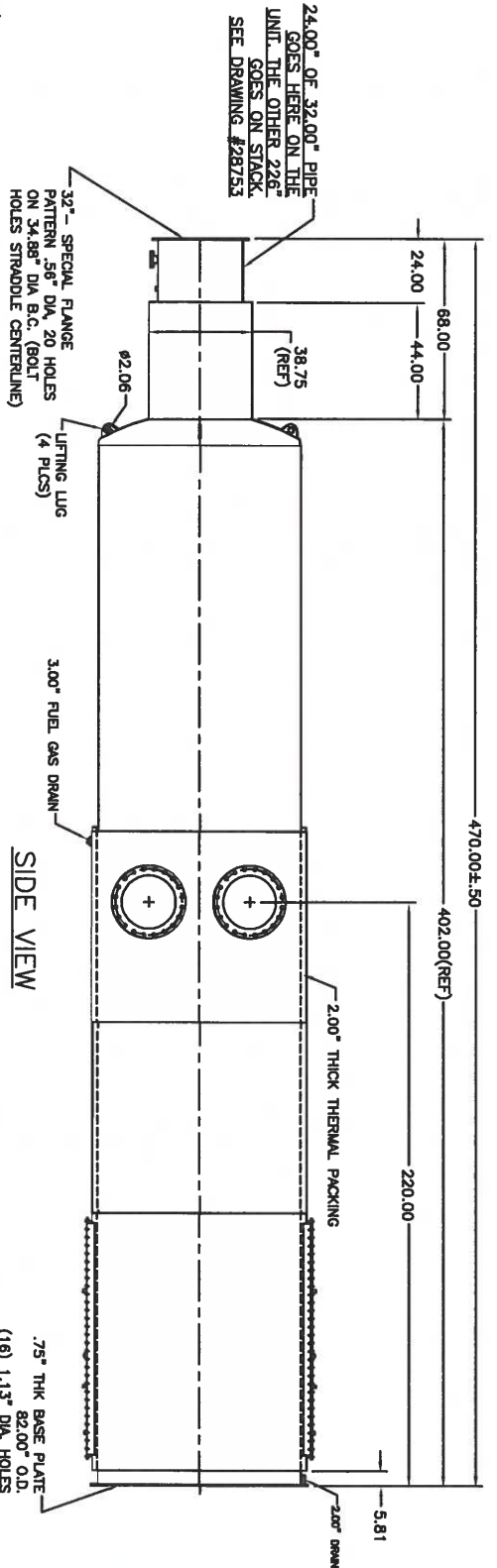
## APPENDIX E FIGURES

- **Figure D-1:** Location of Thermocouple (CMS) in exhaust stack for Units #4-6

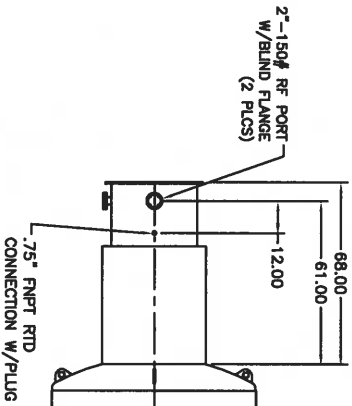
## Figure E-1



TOP VIEW



SIDE VIEW



SIDE VIEW

7.5\"/>

EXPECTED DYNAMIC INSERTION LOSS

Octave Band	31.5	63	125	250	500	1K	2K	4K	8K
Insert Loss dB	21	33	41	44	52	49	48	47	43

APPROX. WT. 21,909 LBS  
NOTE: ALL DIMENSIONS ARE IN INCHES.

12 PANEL CONVERTER/SILENCER

GT EXHAUST SYSTEMS, INC

TOLERANCES (EXCEPT AS NOTED)		REVISIONS		DATE	BY	DESCRIPTION
DECIMAL:	FRACTIONAL:	NO.				
.12"	1/8"	A	UPDATED OUTLET FLANGE PATTERN AND BASE FLANGE	01/17/05	AMH	
		B	UPDATED JACKET	01/18/05	AMH	

216V0-12-\_\_\_-7130-2-28754; 30\"/>

EXTERNAL PAINT  
SANDBLAST TO SSPC-SP5 (WHITE METAL)  
PRIMER-DAMPNEY THURMALOX 245C-ZINC DUST  
TOP COAT-DAMPNEY THURMALOX 280C-SILICONE RESINS  
TOP COAT COLOR-ALUMINIUM

DRAWN BY:	SCALE:	MATERIAL:
AMH	NONE	HRS
APP'D BY:	DATE:	DMG. NO.
	12/13/04	
CUSTOMER:	28754	
CAT 3616 GAS ENGINE		