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**Malfunction Abatement Plan**

**PERMIT TO INSTALL**

67-22

**ISSUED TO**

Kawasaki Motors Corp., U.S.A.

**LOCATED AT**

5080 36th St. SE

Grand Rapids, Michigan 49512

**IN THE COUNTY OF**

Kent

**STATE REGISTRATION NUMBER**

P0677

**DRAFTED AUGUST 2023 BY**

Paul Marvin, Regulatory Compliance Engineer

**Background**

Permit 67-22, part III describes the “Process/Operational Restriction(s)” as requiring:

1. The permittee shall not operate EU-TEST1 through EU-TEST9 unless a malfunction abatement plan (MAP) as described in Rule 911(2), for the PCO, has been submitted within 180 days of permit issuance, and is implemented and maintained. The MAP shall include acceptable pressure and temperature ranges of operation based on the previous PCO performance test. If at any time the MAP fails to address or inadequately addresses an event that meets the characteristics of a malfunction, the permittee shall amend the MAP within 45 days after such an event occurs. The permittee shall also amend the MAP within 45 days, if new equipment is installed or upon request from the District Supervisor. The permittee shall submit the MAP and any amendments to the MAP to the AQD District Supervisor for review and approval. If the AQD does not notify the permittee within 90 days of submittal, the MAP or amended MAP shall be considered approved. Until an amended plan is approved, the permittee shall implement corrective procedures or operational changes to achieve compliance with all applicable emission limits. **(****R 336.1225, R 336.1702(a), R 336.1910, R 336.1911, 40 CFR 52.21(c) and (d))**

Justification: The affected emissions units (EU) described above are subject to CAM due to our potential to emit over 100 tons/yr of CO emissions within each EU. The test cells described as EU-TEST1 through EU-TEST9 are functionally identical test cells, each equipped with a dynamometer capable of testing an engine of up to 50 gross horsepower. All EUs utilize the PCO described below.

**Applicable Regulations**

Durability/Endurance cells EU-TEST1 through EU-TEST9 are equipped with a Pressure Control Oxidizer (PCO). The remining eleven (11) test cells are uncontrolled.

1. **Emissions Limits**

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| **Pollutant** | **Limit** | **Time Period / Operating Scenario** | **Equipment** | **Monitoring / Testing Method** | **Underlying**  **Applicable**  **Requirements** |
| 1. CO | 6.57 lb/galA | Hourly, uncontrolled | FG-TESTCELLS | SC V.1 | 40 CFR 52.21(d) |
| 2. CO | 180.7 tpy | 12-month rolling time period as determined at the end of each calendar month. | FG-TESTCELLS | SC V.2, SC VI.3 | R 336.1205(1)(a) &  (3) |
| 3. Benzene | 291.5 lbs/yr1 | 12-month rolling time period as determined at the end of each calendar month. | FG-TESTCELLS | SC V.2, SC VI.3 | R 336.1225 |
| 4. 1,3-Butadiene | 98.5 lbs/yr1 | 12-month rolling time period as determined at the end of each calendar month. | FG-TESTCELLS | SC V.2, SC VI.3 | R 336.1225 |
| 5. Formaldehyde | 160.9 lbs/yr1 | 12-month rolling time period as determined at the end of each calendar month. | FG-TESTCELLS | SC V.2, SC VI.3 | R 336.1225 |
| 6. Acetaldehyde | 1,144.1 lbs/yr1 | 12-month rolling time period as determined at the end of each calendar month. | FG-TESTCELLS | SC V.2,, SC VI.3 | R 336.1225 |
| Alb/gal = pound per gallon | | | | | |

1. **Materials Limits**

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| **Material** | **Limit** | **Time Period / Operating Scenario** | **Equipment** | **Monitoring / Testing Method** | **Underlying**  **Applicable**  **Requirements** |
| 1. Fuel (any combination of gasoline, ethanol/gasoline blend, E85 | Total 190,000 gallons, of  which no more than 40,000  gallons may be burned uncontrolled | 12-month rolling time period as determined at the end of each  calendar month. | FG-TESTCELLS | SC VI.2 | R 336.1205(1)(a)  & (3),  R 336.1225,  40 CFR 52.21(d) |

Note: The permittee shall only test engines burning gasoline, ethanol, or gasoline/ethanol blends in FG-TESTCELLS. **(R 336.1205, R 336.1224, R 336.1225, 40 CFR 52.21(c) & (d))**

1. **Process/Operational Restrictions**

1. The permittee shall not operate EU-TEST1 through EU-TEST9 unless a malfunction abatement plan (MAP) as described in Rule 911(2), for the PCO, has been submitted within 180 days of permit issuance, and is implemented and maintained. The MAP shall include acceptable pressure and temperature ranges of operation based on the previous PCO performance test. If at any time the MAP fails to address or inadequately addresses an event that meets the characteristics of a malfunction, the permittee shall amend the MAP within 45 days after such an event occurs. The permittee shall also amend the MAP within 45 days, if new equipment is installed or upon request from the District Supervisor. The permittee shall submit the MAP and any amendments to the MAP to the AQD District Supervisor for review and approval. If the AQD does not notify the permittee within 90 days of submittal, the MAP or amended MAP shall be considered approved. Until an amended plan is approved, the permittee shall implement corrective procedures or operational changes to achieve compliance with all applicable emission limits. **(R 336.1225, R 336.1702(a), R 336.1910, R 336.1911, 40 CFR 52.21(c) and (d))**

1. **Design/Equipment Parameters**
2. The permittee shall install and operate devices as necessary to measure the total fuel usage in both controlled and uncontrolled test cells in FG-TESTCELLS. **(R 336.1205(1)(a) & (3), R 336.1225, 40 CFR 52.21(d))**
3. The permittee shall not operate EU-TEST1 through EU-TEST9 unless the associated exhaust is routed to the PCO with a minimum control efficiency of 90% for CO and 95% for VOCs. The permittee shall install, maintain, and operate the PCO in a satisfactory manner acceptable to the AQD District Supervisor and in accordance with the MAP. **(R 336.1205, R 336.1224, R 336.1225** **R 336.1702, R 336.1910)**
4. The permittee shall not operate EU-TEST1 through EU-TEST9 unless a minimum operating temperature of 600°F is maintained in the PCO. **(R 336.1205, R 336.1224, R 336.1225 R 336.1702, R 336.1910)**
5. The permittee shall install an interlock to prevent engine operation until the PCO has reached a minimum operating temperature of 600°F. **(R 336.1205, R 336.1224, R 336.1225 R 336.1702, R 336.1910)**

**PCO**

* **Information:** The installed PCO designed by PCE Monarch described in permit 67-22 affects EU-TEST1 through EU-TEST9.
* **Control Technology:** The PCO described above utilizes a standard catalyst with the primary function of increasing the levels of oxidation of CO to CO2 at a lower temperature than would be required in solely a thermal oxidizer.

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**Performance Criteria**

The information below is descriptive of the PCO described above.

* **Temperature**: Temperature is measured by a thermocouple placed just before the catalyst. The installed PCO maintains a minimum operating temperature of 600°F and a maximum operating temperature of 850°F. If the temperature of the PCO falls outside of this range, engine operation will be stopped and prevented until the operating temperature is corrected. An installed interlock built into the PCE Monarch computer system ensures this operation, and the main screen operator can view the temperature at any time. During engine testing, the PCO temperature is always visible to the main screen operator. warnings sound at 660°F and 800°F.
* **Pressure:** Pressure is measured at the inlet duct. The installed PCO maintains a minimum pressure of -5.0”Wc and a maximum pressure of 0.0”Wc. If the pressure within the PCO falls outside of this range, engine operation will be stopped and prevented until the pressure is corrected. An installed interlock built into the PCE Monarch computer system ensures this operation. Alarm warnings sound at -4.5”Wc and -0.1”Wc.
* **Maintenance:** Catalyst cleaning is performed every 6 months to ensure effective operation. The thermocouple used to monitor temperature is calibrated semi-annually. The pressure drop gauges are also calibrated semi-annually. The PCO is designed to need no other preventative maintenance. Given this, Kawasaki deems it necessary to stock one spare thermocouple and multiple fuses in case of an unexpected malfunction. Any other malfunction would be handled by an outside service that specializes in PCO systems. No other spare parts are kept on hand for this reason. Alarms are installed to monitor the dampers, and any random faults are dealt with on an individual basis.
* **Testing:** Testing is performed every 5 years to ensure a minimum control efficiency of 90% for CO and 95% for VOCs. The last test was performed on September 19th, 2022. No changes have occurred to the control system since the last performance test. The PCO interlock, which prevents operation outside of the parameters described above, is tested twice per year by manually attempting to test an engine while the temperature and pressure are outside of the acceptable ranges.
* **Monitoring:** PCO performance is monitored every 15 minutes as a result of this, ensuring that our rolling-average efficiency of CO and VOC reduction is above the levels specified above. This data will be stored for 5 years. The ductwork associated with the PCO is not designed in a way that allows control system bypass. Therefore, this does not need to be tested.

**Fuel Usage**

* **Monitoring Approach:** Fuel is monitored/tested per SC VI.2. Fuel usage is measured daily, and the corresponding emissions are calculated daily.
* **Tracking:** Fuel usage is tracked separately for controlled and uncontrolled cells by Lab Automation PLC, and uploads values to the log on the OneShot call.
* **Recordkeeping:** Fuel usage is recorded daily, and data is stored for 5 years.

**Contact**

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