Applying the SAE J1667 Snap Acceleration Test Procedure to RTG Cranes

Target Audience

This procedure is designed specifically for RTG cranes that cannot be tested using the standard SAE J1667 procedure. Prior approval of the Executive Officer **is not** required for this modified procedure.

Other than when using this procedure, if performing the SAE J1667 Snap Acceleration Test is not feasible, the end-user must demonstrate that performing the test is not feasible, and use an alternative method of compliance that has been approved by the Executive Officer. The EO must determine whether the alternative procedure causes an increase in soot accumulation rates in the VDECS. This pre-approved procedure, allows end-users to avoid the case-by-case approval requirements for RTG cranes.

Overview

RTG cranes lack the throttle mechanisms commonly found in other vehicles. Therefore, it is impossible to perform the opacity test in the manner normally required.

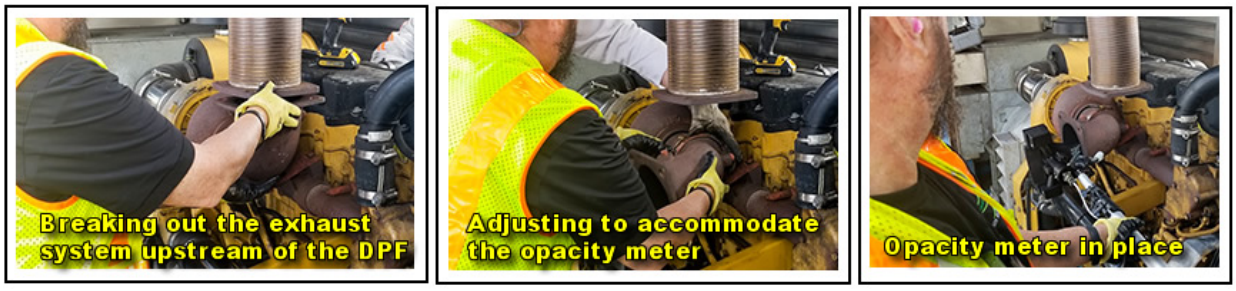
Most RTG cranes operate using a generator set. The diesel engine powers the generator. The engine is switched from *idle speed (650-750 rpm)* to *full speed (1800 rpm)* where it remains during normal operation. The system is designed to maintain 1800 rpm, which enables the generator to deliver consistent electrical frequency (60Hz) and voltage but makes the normal snap acceleration test impossible to administer. However, when the RTG crane begins to lift a load, the engine momentarily drops below 1800 RPM before returning to normal. This somewhat approximates the conditions found in an on-road vehicle during a typical snap acceleration test.

This procedure is performed by lifting the hoist mechanism of the RTG crane without a cargo container or other load attached. It was developed using Cummins and Caterpillar engines. Engines from other manufacturers should function similarly.

Where to Place the Opacity Meter

Cargo handling equipment (CHE), which has been retrofitted with a Diesel Particulate Filter (DPF), must be opacity-tested upstream of the DPF, while equipment that comes from the manufacturer with a DPF in place is tested at the stack or tailpipe as normal. This requirement exists because the retrofitted equipment was originally certified without a DPF in place; so subsequent testing is performed under similar conditions. A DPF greatly reduces but does not eliminate harmful emissions. The upstream testing requirement ensures that the DPF does not mask underlying engine problems.

Figure 1:
RTG Crane with a retrofitted DPF with the exhaust system broken-out at the turbo charger.



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Procedure

This procedure modifies the J1667 opacity test to be used with RTG cranes. All other aspects of the existing J1667 procedure remain in place and should be followed.

Step	Action
1	Start the diesel engine, and allow it to warm-up to normal operating temperature. • Typically, 10 to 15 minutes • Operating the crane often expedites reaching normal temperature
2	Once the engine is at normal operating temperature, lower the hoist mechanism to a low position. • During the test, you will lift the hoist mechanism ***without a cargo container or other weight attached***
3	Attach the opacity testing device as required by the SAE J1667 procedure. • **DPF Retrofit:** Attach opacity test equipment upstream of the DPF • **DPF OEM:** Attach opacity test equipment at the stack or exhaust pipe (downstream of the DPF)
4	On the opacity meter, press the **Start Button** or respond to the prompts to begin the test and to start each snap (varies by device).
5	**Perform the snap:** Lift the crane hoist mechanism for 1- 4 seconds at full speed. • This simulates fully depressing the throttle on an on-road vehicle
6	Stop lifting, and wait 5 to 45 seconds (target 8 to 10 seconds). • Engine should return to normal unloaded RPM (1800 RPM) • If the hoist mechanism is too high to complete the next lifting snap, lower it to a convenient position at a safe speed
7	Repeat steps 5 and 6 for a total of six cycles (three purge & three test). • The three test cycles must be completed within two minutes of the purge cycles
8	End the snap acceleration test.
9	Calculate results based on the nearest two of the three test readings, and retain the test results for your records. • As of this writing, only the *Wager 7500 Smoke Meter* performs CHE calculation automatically. All other opacity meters average all three test values; so the calculation for CHE equipment will need to be performed manually. *See the next page for test criteria and failure instructions.*

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Test Criteria

PM Emission Standards Table

PM Emission Standard		Maximum Opacity
g/kw-hr	g/bhp-hr	
> 0.54	> 0.40	55%
0.42 to 0.54	0.31 to 0.40	45%
0.28 to 0.41	0.21 to 0.30	35%
0.15 to 0.27	0.11 to 0.20	25%
0.07 to 0.14	0.05 to 0.10	15%
< 0.07	< 0.05	5%

Opacity Limits

The ARB Executive Order (EO) lists both the PM certification level and certification standard. The EO for all engines can be found on the ARB website:

https://www.arb.ca.gov/msprog/offroad/cert/cert.php

Calculating Test Results for CHE

Average the closest two of the three snap test results. As of this writing, only the *Wager 7500 Smoke Meter* performs CHE calculation automatically. All other opacity meters average all three test values; so the calculation for CHE equipment will need to be performed manually.

Example: Given readings of 3%, 4%, and 6.5%, the closest two values of 3% and 4% would be averaged together for a final opacity test result of 3.5%.

Failure Instructions

If the equipment fails the opacity test:

- Take the equipment out of service and repair the engine as required
- After making the required repairs, test the equipment again using the same procedure and calculation method
- The opacity test results after repairs may not be more than five percentage points higher than the maximum defined in the CHE regulation, or the equipment may not be placed back into service
    - For example: If the maximum opacity is 35% the maximum opacity after repairs would be 40%; for a maximum opacity of 45%, the maximum opacity after repairs would be 50%