



ELEVATED STANDARDS. DEEPER INSIGHT.

Dealing with Quad O, Quad J and Quad Z Regulations



Brad Stevener, *Manager of Environmental Services*

February 5, 2014



INTRODUCTION

There are two federal rules that potentially apply to spark-ignited internal combustion engines (drivers):

- NSPS JJJJ (also called Quad J)
- MACT ZZZZ (also called Quad Z or RICE MACT)

Note: NSPS IIII and MACT ZZZZ also potentially applies to compression-ignited internal combustion engines but is not included in this presentation

There is also a federal rule that potentially applies to compressors:

- NSPS OOOO (also called Quad O)



QUAD O

- OOOO and how it applies to a compressor package:
 - Applies to packages initially constructed, reconstructed or modified after August 23, 2011
 - Replace compressor rod packing every 3 years
 - Can also choose to replace packing every 26,000 hours of operation but must track operating hours closely
 - Replace any natural gas actuated continuous-bleed pneumatic devices with intermittent or no-bleed (gas plants) devices if ordered after August 23, 2011 (such as liquid level controllers on separators)
 - Does NOT apply to packages at transmission compressor stations



QUAD J

- JJJJ and how it applies to a compressor package:
 - Potentially applies to all gas fired spark-ignited reciprocating engines

Engine Type	Maximum Engine Horsepower	Engine Manufacture Date	Emission Limits					
			grams/hp-hr			ppmvd @ 15% O ₂		
			NO _x	CO	VOC	NO _x	CO	VOC
Non-Emergency	25<hp<100	After 06/30/2008	2.8	4.8	N/A	N/A	N/A	N/
Non-Emergency	100≤hp<500	07/01/2008 to 12/31/2010	2.0	4.0	1.0	160	540	86
		After 12/31/2010	1.0	2.0	0.7	82	270	60
Non-Emergency and Lean Burn	500≤hp<1,350	01/01/2008 to 06/30/2010	2.0	4.0	1.0	160	540	86
		After 06/30/2010	1.0	2.0	0.7	82	270	60
Non-Emergency (except lean burn 500≤hp<1,350)	hp≥500	07/01/2007 to 06/30/2010	2.0	4.0	1.0	160	540	86
	hp≥500	After 06/30/2010	1.0	2.0	0.7	82	270	60
Emergency	25<hp<130	After 12/31/2008	10	387	N/A	N/A	N/A	N/A
	hp≥130		2.0	4.0	1.0	160	540	86

- Engine testing requirements under JJJJ:
 - For units **25 < hp ≤ 500**, an initial performance test shall be conducted within 180 days of start-up. This is a **one-time** test that is good for the life of the engine even if it is moved to another location. Subsequent performance tests are **not** required unless the engine is modified or reconstructed.
 - For units **> 500 hp**, an initial performance test shall be conducted within 180 days of start-up. Subsequent performance testing **must** be conducted every 8,760 operating hours or 3 years, whichever comes first.
 - Performance tests must be conducted within 10% of peak load and must consist of three runs of at least one hour each. (e.g., if you want max allowable load to be full load, unit must be tested at 90% of full load. If tested at 70% load, operation is limited to 80% of full load until next test.)



QUAD Z

- ZZZZ and how it applies to a compressor package:
 - Potentially applies to all compression and spark-ignited reciprocating engines
 - Definitions:
 - **Major Source** – A site is a major source if the total amount of HAP's (i.e., formaldehyde) that it emits is greater than 25 tons/year, or if it emits any single HAP greater than 10 tons/year.
 - **Area Source** – A facility that does not meet the definition of a major source.
 - **Existing (any engine at a major source AND greater than 500 hp)** – Any engine initially constructed before December 19, 2002.
 - **Existing (any engine at an area source OR any engine at a major source less than or equal to 500 hp)** – Any engine initially constructed before June 12, 2006.
 - **New** – Any engine that does not meet the definition of an existing engine from above. Also includes any engine that was modified or reconstructed after the dates given above.

- Definitions (cont.):
 - **Remote Source:**
 - **Located offshore** and beyond the line marking the seaward limit of inland waters
 - **Located on a pipeline segment** with 10 or fewer buildings intended for human occupancy and with four or more stories within 220 yards on either side of a continuous one-mile length of pipeline (similar to DOT Class 1 area), **and** the segment is not within 100 yards of a building or small well-defined outside area (playground, recreation area, outdoor theater, etc.) that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period.
 - **Not located on a pipeline segment** and having 5 or fewer buildings intended for human occupancy **and** no buildings with 4 or more stories within 0.25 mile radius around the engine

– Emission Requirements

Compliance Deadline – June 15, 2007

Compliance Deadline – October 19, 2013

Compliance Deadline – Upon start-up

HP	Major Source						Area Source				
	Existing			New/Recon			Existing			New/Recon	
	4SRB	4SLB	2SLB	4SRB	4SLB	2SLB	4SRB	4SLB	2SLB	4SRB	LB
> 500	NSC1	none	none	NSC1	OC2	OC1	NSC3/WP2*	OC5/WP2*	WP3	JJJJ	JJJJ
250-500	NSC2	OC4	OC3	JJJJ	OC2	JJJJ	WP1	WP1	WP3	JJJJ	JJJJ
100-249	NSC2	OC4	OC3	JJJJ	JJJJ	JJJJ	WP1	WP1	WP3	JJJJ	JJJJ
25-99	WP1	WP1	WP3	JJJJ	JJJJ	JJJJ	WP1	WP1	WP3	JJJJ	JJJJ

LB – lean-burn; **4SRB** – four-stroke rich-burn; **4SLB** – four-stroke lean-burn; **2SLB** – two-stroke lean-burn; **JJJJ** – JJJJ overrides ZZZZ

OC – oxidation catalyst (reduces CO and VOC but does not reduce NOx)

- 1 – Reduce CO emissions by 58% or limit the concentration of formaldehyde in exhaust to 12 ppmvd at 15% O₂
- 2 – Reduce CO emissions by 93% or limit the concentration of formaldehyde in exhaust to 14 ppmvd at 15% O₂
- 3 – Limit the concentration of CO in exhaust to 225 ppmvd at 15% O₂
- 4 – Limit the concentration of CO in exhaust to 47 ppmvd at 15% O₂
- 5 – Reduce CO emissions by 93% or limit the concentration of CO in exhaust to 47 ppmvd at 15% O₂

NSC – non-selective catalyst, also called three-way catalyst (reduces NOx, CO and VOC)

- 1 – Reduce formaldehyde emissions by 76% or limit the concentration of formaldehyde in exhaust to 0.35 ppmvd at 15% O₂
- 2 – Limit the concentration of formaldehyde in exhaust to 10.3 ppmvd at 15% O₂
- 3 – Reduce CO emissions by 75% or limit the concentration of CO in exhaust to 270 ppmvd at 15% O₂ or reduce THC by 30%

WP – Work Practice

- 1 - change oil, spark plugs and inspect belts/hoses every 1,440 hours.
- 2 - change oil, spark plugs and inspect belts/hoses every 2,160 hours.
- 3 - change oil, spark plugs and inspect belts/hoses every 4,320 hours.

* If the facility is in a remote area, comply with WP2. Otherwise, comply with NSC3 or OC5.

– Oil Analysis Program Option

- If you operate an engine that is subject to the work practices, you have the option of utilizing an oil analysis program in order to extend the specified oil change requirement. The oil analysis must be performed at the same frequency specified in the work practice for changing the oil. The analysis program must at a minimum analyze the following three parameters: **Total Acid Number, viscosity, and percent water content**. The condemning limits for these parameters are as follows: the Total Acid Number increases by more than 3.0 milligrams of potassium hydroxide (KOH) per gram from Total Acid Number of the oil when new; the viscosity of the oil has changed by more than 20 percent from the viscosity of the oil when new; or the percent water content (by volume) is greater than 0.5. If any of the limits are exceeded, the engine owner or operator must change the oil within 2 **business** days of receiving the results of the analysis; if the engine is not in operation when the results of the analysis are received, the engine owner or operator must change the oil within 2 business days or before commencing operation, whichever is later. The owner or operator must keep records of the parameters that are analyzed as part of the program, the results of the analysis, and the oil changes for the engine. The analysis program must be part of the maintenance plan for the engine.

– Catalyst Operating/Monitoring Requirements

HP	Major Source						Area Source				
	Existing			New/Recon			Existing			New/Recon	
	4SRB	4SLB	2SLB	4SRB	4SLB	2SLB	4SRB	4SLB	2SLB	4SRB	LB
> 500	1,3			1,3	1,2	1,2	3*	2*			
250-500					1,2						
100-249											
25-99											

1 - maintain catalyst so that the pressure drop across the catalyst does not change by +/- 2 inches of water at 90% load from the pressure drop measured during initial performance test. Pressure drop must be monitored monthly after initial test, but only at 90% load.

2 - maintain the temperature of the exhaust so that the catalyst inlet temperature is 450 to 1350 degrees F. Recordings must be taken every 15-minutes and then compiled into 4-hour rolling averages; or, install immediate shutdown if inlet temperature exceeds 1350 degrees F.

3 - maintain the temperature of the exhaust so that the catalyst inlet temperature is 750 to 1250 degrees F. Recordings must be taken every 15-minutes and then compiled into 4-hour rolling averages; or, install immediate shutdown if inlet temperature exceeds 1250 degrees F.

* Only required if unit is a non-remote source.

– Testing Requirements

HP	Major Source						Area Source				
	Existing			New/Recon			Existing			New/Recon	
	4SRB	4SLB	2SLB	4SRB	4SLB	2SLB	4SRB	4SLB	2SLB	4SRB	LB
> 500	TR1	none	none	TR1	TR1	TR1	TR2/MP*	TR2/MP*	MP	JJJJ	JJJJ
250-500	TR1	TR1	TR1	JJJJ	TR3	JJJJ	MP	MP	MP	JJJJ	JJJJ
100-249	TR1	TR1	TR1	JJJJ	JJJJ	JJJJ	MP	MP	MP	JJJJ	JJJJ
25-99	MP	MP	MP	JJJJ	JJJJ	JJJJ	MP	MP	MP	JJJJ	JJJJ

JJJJ – JJJJ overrides ZZZZ; see JJJJ for testing requirements.

MP – Testing not required. Maintenance Plan must be developed that specifies how the work practices will be met.

TR – Testing Requirement

- 1 – Conduct an initial performance test within 180 days after start-up
Conduct semi-annual performance tests for CO or formaldehyde**
- 2 – Conduct an initial performance test within 180 days after start-up
- 3 – Conduct an initial performance test within 240 days after start-up
Conduct semi-annual performance tests for CO**

* If the facility is in a remote area, comply with MP. Otherwise, comply with TR2.

** After you have demonstrated compliance for two consecutive tests, you may reduce the frequency of subsequent performance tests to annually. If the results of any subsequent annual performance test indicate the engine is not in compliance with the CO or formaldehyde emission limitation, you must resume semiannual performance tests.



QUESTIONS?