Environmental Protection Agency

Horiba Emission Analysis System Tracer Gas Injection Procedure

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NVFEL Reference Number

009C

Implementation Approval

Original Procedure Authorized by EPCN #247 on 02-21-2000

Revision Description

(1) 03-14-2000 The purpose of this change is to revise the procedure as described in EPCN #277. All steps affected by this change are identified with (1) in the margin.

(2) 09-18-2001 The purpose of this change is to update the Group Responsible name per EPCN #316

(3) 11-13-2002 The purpose of this change is to update the Group Responsible name per EPCN #337

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1. Purpose

The purpose of this working procedure is to describe the equipment and steps required to perform a Propane Injection Procedure on the Horiba Emission Analysis System, Series 7200, using a Critical Flow Orifice (CFO) kit.

2. Test Procedure

- 101 Turn on the test site air handling system and wait a minimum of 15 minutes for the site temperature to stabilize.
- 102 Place a CFO kit with a valid calibration sticker in the test cell and allow the kit temperature to stabilize for a minimum of 20 minutes.
- 103 In the test cell: remove the cover of the cleanout port and insert the kit rosette in the cleanout port at the bottom of the tunnel assembly

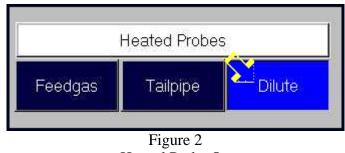
or disconnect the exhaust pipe and place the kit rosette in the exhaust pipe.

- 104 In the control room, ensure that the Power Tech computer is powered up and VXIN is turned on according to the VXIN startup procedure.
- 105 On the Power Tech computer, select "CVS Blower" from the soft panel at the bottom of the screen. See the arrow in Figure 1.

MEXA Transfer	Ne w Test	Continuous Log	Singlemode Log	SnapAcc Test	Nmode Test	Soft	Stop
Enable Drive			Reset System / Safeties		Fan	Abort Test	Alarm Reset
Enable Starter		L	Launch		CVS Blower	Hold Test	Next Stage
Speed / Position		n Speed	d / Torque	Torque /	Position	AUTO MODE	MANUAL MODE

Figure 1 CVS Blower Screen

(1) 106 On the Power Tech computer secondary display screen Heated Probes subpanel, select "Dilute" to turn on the heated probe. See the arrow in Figure 2.



Heated Probe On

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- 107 Ensure the Horiba Emission Analysis System is powered up according to the Horiba startup procedure and that the Horiba computer command screen is displayed.
- 108 On the Horiba computer command screen, select the "THC" button for the MEXA analyzer. See the arrow in Figure 3. Select "Cal" from the menu displayed. See the circle in Figure 3. An automatic zero span calibration procedure will begin (green=zero, blue=span).

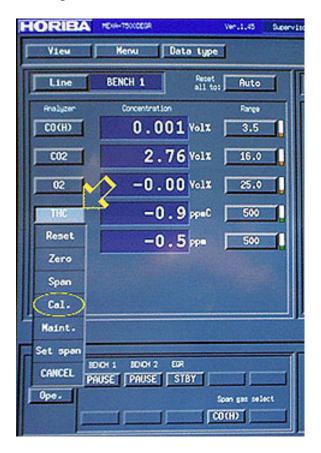


Figure 3 Cal Selection Screen

109 Ensure that the test processing computer is powered on.

Open the Excel program.

From the file menu, select Open, C:/calibration/propanes.xls.

110 Select "Propane2,YY.MM.DD.dil.xls" from the list of files.

See the highlighted file name in Figure 4.

Open					? ×
Look in: Propanes	· 🗈	000	<u>###</u> ##	Σ	
Name		Туре	Modified	-	Öpen
Propane2, yy.mm.dd.dl.xds			12/9/99 7:02 AM		Curved
Propane2,99.11.30.dl.xis	32 KB	Microsoft Excel	11/30/99		Cancel
Propane2,99.11.27.C8.dl.xls	32 KB 1	Microsoft Excel	11/27/99 11:	_	Advanced
Propane2,99.11.22.dl.xis	35 KB I	Microsoft Excel	11/22/99 10:		
Propane2,99.10.26.dl.xis	33 KB (Microsoft Excel	10/26/99		
Propane2,99.09.29.dil.xis	35 KB 1	Microsoft Excel	9/29/99 4:10 PM		
Propane2,99.09.23.dl.xis	32 KB (Microsoft Excel	9/23/99 3:51 PM		
Propane,99.08.05.hor.xis	32 KB (Microsoft Excel	8/5/99 10:26 AM		
Propane,99.07,30.dl.xls	27 KB 1	Microsoft Excel	7/30/99 2:46 PM		
Propane,99.07.21.dl.xis	32 KB I	Microsoft Excel	7/21/99 4:52 PM	*	
Find files that match these search criteria					
Fie name: Propane2, yy. mm. d	d.dl.xls 💽 T	e <u>xt</u> or property:		٠	End Now
Files of type: Microsoft Excel Files (*.xi*	; *.xis; *.xia; 💌 La	ast modified:	any time	٠	New Search
40 file(s) found.					

Figure 4 Open File Screen

009	С	Horiba Emission Analysis SystemPage 6 of 18Tracer Gas Injection Procedure							
1		listed un	derne		egories list	-		ect each yellov eyboard to ent	• 1
		Test Dat	e, see	the arrow	labeled A	n Figure 5			
		Test Tin	ne, see	e the arrow	labeled B	in Figure 5			
		Operator	r ID, s	see the arro	w labeled	C in Figure 5			
		CVS ID, see the arrow labeled D in Figure 5							
		CFO Pro	operty	ID, see th	e arrow lab	eled E in Fig	ure 5		
		Analyze	r (PR	E CAT, PO	OST CAT, I	DILUTE), se	e the arrow	v labeled F in	Figure 5
	1	2		3	4	5	6	7	8
1		_		PRO	PAHE PROCES	SOR		Processed	± 01/12/00 10:11
2		<u>.</u>			Input Data				
4	- X.	2	ВZ	T	i est identificati	201			- 62
5	Test	Tes	1	-	nbient Conditio				Operator
8	Date	Tier				Baro Pressure			D
7	11/30/	93	2.30			29.7	Hg		42137
8	- ×	2							

Figure 5 Propane Processor Input Data

Analyzer

Blogd Reading Sample Reading

4,1

İF

Assalyzen A301 Bench1

CVS Data

Gas Data

128.5 ppmC

D

CV9

1D

Property ID

10.64

12 Horiba CVS 13

9

10

11

14 16

16

17 18

749.5 SCFM

Temp (F) Gauge Press 74.8 90

cvs

Flow Reading

CFO

112 On the "PROPANE PROCESSOR Input Data" screen, check the "CFO Calibration Coefficients" in column 5, rows 105, 106, and 107 against the current coefficients listed on the CFO kit. If they are the same, proceed to the next Step. If they are not the same, change the screen coefficients to those listed on the CFO kit. See the circle in Figure 6.

26 PROP v1.2	PROPANE PROCESSOR				
102		CFO Calculations			
103					
104 CFO PID	38625	CFO Calibration Coefficents:			
105 CFO Temp	74.0	Coeff 1 2.75960E-06			
106 CFO Gauge Pres	90	Coeff 2 6.79729E-03			
107 PSI	14.58864	Coeff 3 -1.44540E-02			
100 PSIA	104.50064				
PROPANE V	/BK//				

Figure 6 CFO Calibration Coefficients

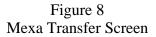
113 Check barometer in Large Soak, return to the computer and enter the data in the yellow field under "Baro Pressure" on the "PROPANE PROCESSOR Input Data" screen. See the arrow in Figure 7.

	1	2	3	4	5	6	7	8
1			PRO	PANE PROCES	SSOR		Processed	01/12/00 10:11
2				Input Data				
3								
4			Te	ist Identificati	ion 💉			
5	Test	Test	Arr	bient Conditi	ons 😽			Operator
6	Date	Time			Baro Pressure			ID ID
7	11/30/99	2.30			29.7	"Hy		42137
8								
9				CVS Data				
10	CVS	CVS						1
11	ID ID	Flow Reading						
12	Horiba CVS	749.5	SCEM					
13								
14				Gas Data				
15		CFO				Analyzer		
16	Property ID	Temp (F)	Gauge Press		Analyzen	Bkgd Reading	Sample Reading	
17	38625	74.8	90		A301 Bench1	4.1	128.5	ppmC
18								

Figure 7 Barometer Pressure Input Data

- 114 On the Power Tech computer, select "Menu" at the top of the screen. Select "Upper Display" from the menu that appears. Select "TGI" from the next menu.
- 115 On the Power Tech computer select "Mexa Transfer" in the soft panel at the bottom of the screen. See the arrow in Figure 8.

MEXA New Transfer Test	Continuous Sin Log	glemode SnapAco Log Test	Nmode Test	Soft	Stop
Enaule Drive	Rese System / S		Fan	Abort Test	Alarm Reset
Enable Starter	Laund	ch Chg Amp Reset	CVS Blower	Hold Test	Next Stage
Speed / Position	Speed / T	Torque Torque	Torque / Position		MANUAL MODE



116 On the Power Tech computer, check the CVS flow reading in the field next to "qvEpacvsBoxcar" See the arrow in figure 9. The data will be used in the next step.

KEPACVS_C1	132.30			
tEPACVS_CFV	26 degC			~
pEPACVS_CFV	-0.5 kPaG			<u>- 21</u>
pCELL_AMBIENT	99.1 kPaA		qvEpacvsBoxcar	753.0 SCFM
L_AMBIENT-pEPACVS_0	CFV)/((tEPACVS	_CFV+	273.15)^0.5)	
kCFO_C0	0.003261230			
kCFO_C1	0.006373570			
kCFO_C2	0.000004830			
pCFO_ABS	14.37 p	sia		
tCF0	0.00 d	egF		
conHC_COR	0 p	pm	qvEPACVS_TGI	000000.00 SCFM

Figure 9 qvEpacvsBoxcar

117 On the test processing computer "PROPANE PROCESSOR Input Data" screen in the yellow field under "Flow Reading, enter the data from Step 116. See the arrow in Figure 10.

	1	2	3	4	5	6	7	8
1			PRO	PANE PROCE	SSOR		Processed	01/12/00 10:11
2				Input Data				
3								
4			Te	rst Identificati	ivn			
5	Test	Test	Arr	bient Conditi	ons			Operator
6	Date	Time			Baro Pressure			ID
7	11/30/99	2.30			29.7	"Hg		42137
8								
9				CVS Data				
10	CVS	CVS						
11	ID ID	Flow Reading						
12	Horiba CVS	749.5	SCEM					
13		2.						
14		\sim		Gas Data				
15		CFO				Analyzer		
16	Property ID	Temp (F)	Gauge Press		Analyzon	Bkgd Reading	Sample Reading	
17	38625	74.8	90		A301 Bench1	4.1	128.5	ppmC
18								

Figure 10 Flow Reading Input Data

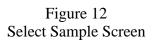
118 Select the "Ope." button under "Line" in the lower left corner of the Horiba Main Control Unit (MCU). See the arrow in Figure 11. The line selector panel will appear. Select the button below the line for the bench under test. From the next menu, select the line for dilute measurement.



Figure 11 Ope Selection Screen

119 Select the "Sample" button under "Line" in the lower left corner of the Horiba MCU. See the arrow in Figure 12.





"Ope." will return under "Line"

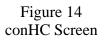
120 In the lower left corner of the Horiba MCU, select "Standby". See the arrow in Figure 13. Select "Measure" from the menu panel that appears. See the circle in Figure 13.

Analyzen	Concentration	Range
CO(H)	0.000 Volz	3.5
C02	2.78 Volz	16.0
02	-0.00 Volz	25.0
THC	Reset 7 ppmC	500
NOx	Measure 3 ppm	500
	Purge	- Balan
and the second second	Zero	
	Span	
-	Cal.	
	Simult.	
Line IDO	CANCEL	
Ope./Sel. STBY	STBY STBY	
Ope.		Scen gas select CO(H)

Figure 13 Measure Screen

121 On the Power Tech computer, check the background reading in the field next to ""conHC" field See the circle in Figure 14. The data will be used in the step 123.

Select \	/enturi	kEPACVS_C1	132.30
idCF0	0	TEPACVS_CFV	26 degC
		pEPACVS_CFV	-0.5 kPaG
		pCELL_AMBIENT	99.1 kPaA
qvEPACVS =	kEPACVS_C1*(p	CELL_AMBIENT - pEPACVS	CFV)/((tEPACVS_CFV)
dCFO	0	kCFO_C0	0.003261230
conBen2HC	0 ppm	kCF0_C1	0.006373570
Read An	nbient	kCFO_C2	0.000004830
pCFO	0.00 psi +	-> pCFO_ABS	14.37 psia
PCELL_AMBIENT	99.1 kPaA	tCFO	0.00 degF
conHC	0.0 ppm	-> conHC_COR	0 ppm
conHC_AMB	0.0 ppm		



122 In the lower left corner of the Horiba MCU screen, select the "Standby" button. See the arrow in Figure 15. Select "Reset" from the menu that appears. See the circle in Figure 15. The sample pump will shut off.

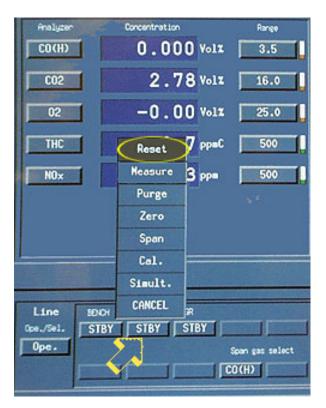
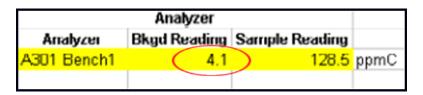
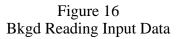


Figure 15 Reset Screen

(3)

123 On the test processing computer "PROPANE PROCESSOR Input Data" screen in the yellow field under "Bkgd Reading", enter the data from Step 121. See the circle in Figure 16.





124 Return to the test cell and verify that the CFO kit pressure reading needle is at zero. If not, adjust it to zero.

To ensure that you reading the CFO kit pressure reading correctly, use the mirrored surface on the face of the gauge and align the needle so you do not see the reflection of the needle. See Figure 17 for proper alignment. See the arrow in Figure 18 for an example improper needle alignment. Notice that there is no reflection of the needle in the mirrored surface when properly aligned.

Proper alignment of the needle ensures that you get the correct pressure readings. Use this method for a setting and reading zero and sample pressures.



Figure 17 Properly Aligned CFO Pressure Needle Reading



Figure 18 Improperly Aligned CFO Pressure Needle Reading

125 Open the valve on the CFO kit propane tank. Use the regulator on top of the bottle to adjust the pressure to 90 ±5 psi. See Figure 19. Allow a minimum of 10 minutes for stabilization. Read the set pressure again and verify that you are within ±5 psi of 90 psi.

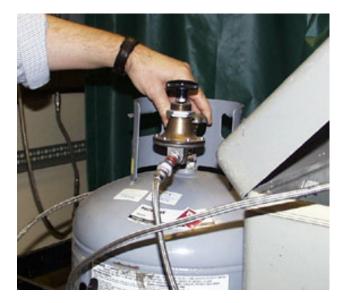


Figure 19 Propane Tank

126 In the lower left corner of the Horiba MCU, select "Standby." See the arrow in Figure 20. Select "Measure" from the menu panel. See the circle in Figure 20.

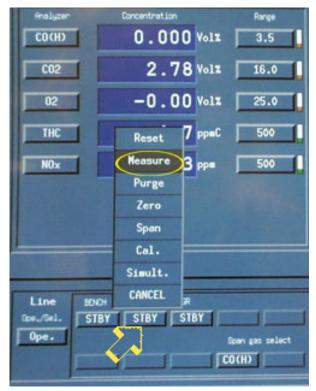


Figure 20 Measure Selection Screen

Horiba Emission Analysis System Tracer Gas Injection Procedure

127 Return to the test cell and take the pressure and temperature reading from the CFO kit. See the arrows in Figure 21. The data will be used in Step 128.

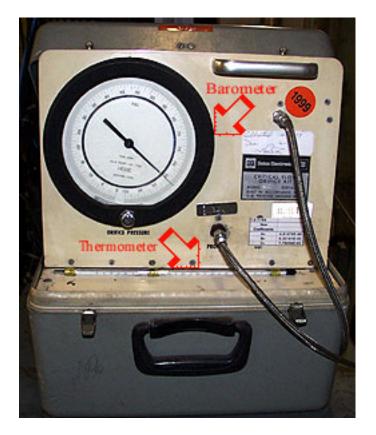


Figure 21 Critical Flow Orifice Kit

128 On the test processing computer "PROPANE PROCESSOR Input Data" screen in the yellow cells below "CFO Temp (F)" and "Gauge Press", enter the temperature and pressure data from Step 127. See the circle in Figure 22.

15 16 17 18	Property ID	CFO Temp (F)	Gauge Press	
17	38625	74.8	90	>
18				

Figure 22 CFO Temp & Gauge Press Input Data

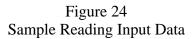
129 On the Power Tech computer, check the sample reading in the field next to ""conHC" field. See the circle in Figure 23.

0		
	TEPACVS_CFV	26 degC
	pEPACVS_CFV	-0.5 kPaG
	PCELL_AMBIENT	99.1 kPaA
PACVS_C1 * (pC	ELL_AMBIENT - pEPACVS	_CFV)/((tEPACVS_CFV
0	KCEO, CO	0.003261230
0 ppm		0.006373570
nt		0.000004830
0.00 psi + -		14.37 psia
	tCFO	0.00 degF
0.0 ppm	-> conHC_COR	0 ppm
	0 0 ppm nt 0.00 psi 99.1 kPaA 0.0 ppm	PCELL_AMBIENT PACVS_C1 * (pCELL_AMBIENT - pEPACVS 0 kCFO_C0 0 ppm kCFO_C1 nt kCFO_C2 0.00 psi +> pCFO_ABS 99.1 kPa4 tCFO 0.00 ppm +> pCFO_ABS 99.1 kPa4 tCFO

Figure 23 conHC Sample Reading Screen

130 On the test processing computer "PROPANE PROCESSOR Input Data" screen in the yellow field under "Sample Reading", enter the data from the Step 129. See the circle in Figure 24.

Analyzer				
Arralyzer	Bkgd Reading	Sample Reading		
A301 Bench1	4.1	(128.5)ppmC	>	



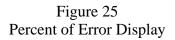
Horiba Emission Analysis System Tracer Gas Injection Procedure

131 On the test processing computer keyboard, press <Enter>. The Excel spreadsheet program will automatically calculate and display the results in the form of percent-of-error below the "Error" cell.

Verify that the result under "Error" is equal to or less than $\pm 2\%$. See the circle in Figure 25. If it is, proceed to the next step.

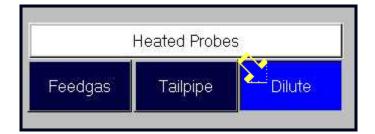
If the error is greater than $\pm 2.0\%$, contact a senior technician for further instructions.

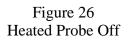
19		Results
20		
21	Injected Mass Rate	Error
22	1.63079031	(-1.09004633)
23	Recovered Mass Rate	
24	1.61301394	
25		



- 132 Select "File" on the test processing computer screen, then select "Print" from the menu displayed. Select "Print" in the printer dialog box.
- 133 Place the printout in the site Propane Calibration folder.
- 134 Select "File" on the test processing computer screen, then select "Save as" from the menu displayed. In the "Save as" dialog box, select the file name "Propane2.yy.mm.dd.dil.xls" which will then appear in the file name box at the bottom of the dialog box.
- Edit the file name by using the keyboard to enter the year, month and date of the test in the yy.mm.dd format. Use the mouse to select the "Save "button.
- 136 Select "File" on the test processing computer screen, then select "Exit" from the menu displayed. When the dialog box, "Do you want to save the changes you made to Propane2.yy.mm.dd.dil.xls?" appears, select the "No" button.
- 137 On the test processing computer, close remaining screens until the standard desktop remains. If further tests are not scheduled, shut down the computer.
- 138 Return to the test cell and close the valve on the propane tank.

- 139 Select "Displays" from the top portion of the Power Tech computer screen and select "Upper displays" from the menu. Select "EPAX TDD" from the next menu.
- 140 Return to the test cell and ensure that the CFO kit pressure has fallen to zero.
- 141 In the control room, on the soft panel portion of the Power Tech computer screen select "CVS Blower" to turn it off. Select "Heated Probe" to turn it off. If further tests are not scheduled, perform the VXIN shutdown procedure.
- (1)142 On the Power Tech computer Heated Probes subpanel, select "Dilute" to turn off the heated probe. See the arrow in Figure 26. If further tests are not scheduled, perform the VXIN shutdown procedure.





- 143 If further tests are not scheduled, turn off the air handling.
- 144 Return the CFO kit to the appropriate storage area.

3. Acceptance Criteria

- 3.1 Allow the test site temperature to stabilize for a minimum of 15 minutes before starting the procedure.
- 3.2 The CFO propane kit used must have a valid calibration sticker.
- 3.3 Allow the CFO propane kit temperature to stabilize for a minimum of 20 minutes after it has been moved into the test site.
- (3) 3.4 The CFO kit pressure reading needle must be properly set to zero after temperature stabilization and before the valve is opened.
 - 3.5 Allow a minimum of 10 minutes for the propane tank to stabilize after opening the valve and adjusting the pressure to 90 ± 5 psi.
 - 3.6 The percent of error must be equal to or less than $\pm 2.0\%$ (displayed under "Results" on the "Propane Processor" data screen).