

# AIR FORCE QUALIFICATION TRAINING PACKAGE (AFQTP)



FOR  
LIQUID FUEL SYSTEMS MAINTENANCE  
(3E4X2)

MODULE 12

TOOLS AND EQUIPMENT

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Career Field Education and Training Plan (CFETP) references from 1 Jul 02 version.

OPR: HQ AFCESA/CEOF  
(SMSgt James B. Lucas)  
Supersedes AFQTP 3E4X2-12, 1 Oct 1999

Certified by: HQ AFCESA/CEOF  
(CMSgt Myrl F. Kibbe)  
Pages: 16/Distribution F

**Notice.** This AFQTP is NOT intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

**AIR FORCE QUALIFICATION TRAINING PACKAGES  
FOR  
LIQUID FUEL SYSTEMS MAINTENANCE  
(3E4X2)**

**INTRODUCTION**

*Before starting this AFQTP, refer to and read the “[AFQTP TRAINER/TRAINEE GUIDE](#).”*

***AFQTPs are mandatory and must be completed*** to fulfill task knowledge requirements on core and diamond tasks for upgrade training. ***It is important for the trainer and trainee to understand*** that an AFQTP ***does not*** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

***AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.***

**MANDATORY minimum upgrade requirements:**

***Core task:***

AFQTP completion  
Hands-on certification

***Diamond task:***

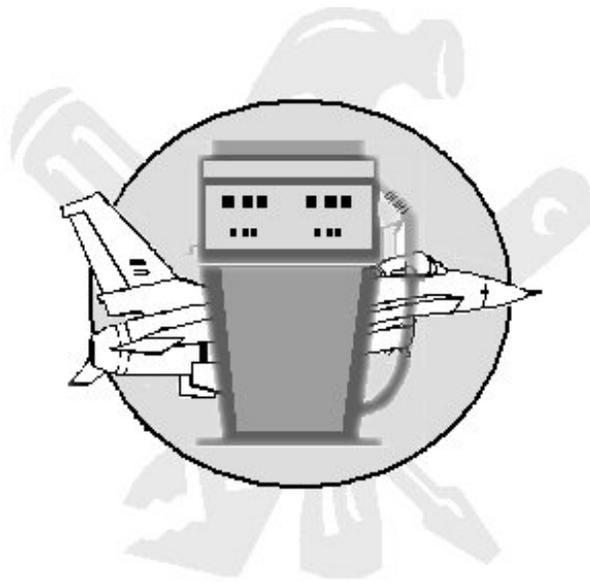
AFQTP completion  
CerTest completion (80% minimum to pass)

***Note:*** *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location.*

***Put this package to use.*** Subject matter experts under the direction and guidance of HQ AFCESA/CEOF revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

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## TOOLS AND EQUIPMENT

MODULE 12

AFQTP UNIT 4

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### USE VAPOR/OXYGEN INDICATOR (12.4.)

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**USE VAPOR/OXYGEN INDICATOR**  
***Task Training Guide***

<b>STS Reference Number/Title:</b>	12.4., Use Vapor/oxygen indicator.
<b>Training References:</b>	<ol style="list-style-type: none"> <li>1. Career Development Course (CDC) 3E452, Liquid Fuel Systems Maintenance, Volume 3, Unit 4-2, Section 439: <i>Using an Alarm System, Combustible Gas and Oxygen Indicator (Gas Sniffer)</i>.</li> <li>2. <a href="#">Technical Order (T.O.) 11H5-35-1, Alarm System, Combustible Gas and Oxygen Indicator, Automatic.</a></li> </ol>
<b>Prerequisites:</b>	<ol style="list-style-type: none"> <li>1. <b>Possess as a minimum a 3E432 AFSC.</b></li> <li>2. <b>Review the following reference:</b> <ol style="list-style-type: none"> <li>2.1. T.O. 11H5-35-1.</li> <li>2.2. CDC 3E452, Liquid Fuel System Maintenance, Volume 3, Unit 4-2, Section 439.</li> </ol> </li> </ol>
<b>Equipment/Tools Required:</b>	BACHARACH 514M or equivalent.
<b>Learning Objective:</b>	Trainee will know how to use a vapor/oxygen indicator.
<b>Samples of Behavior:</b>	Trainee will know how to connect calibration equipment, perform operational checks, and conduct a vapor test.
<b>Notes:</b>	<ol style="list-style-type: none"> <li>1. To successfully complete this element follow the steps outlined in the applicable technical manual—no exceptions.</li> <li>2. Equivalent indicators may be found in Allowance Standards (AS) 488, Section C.</li> </ol>

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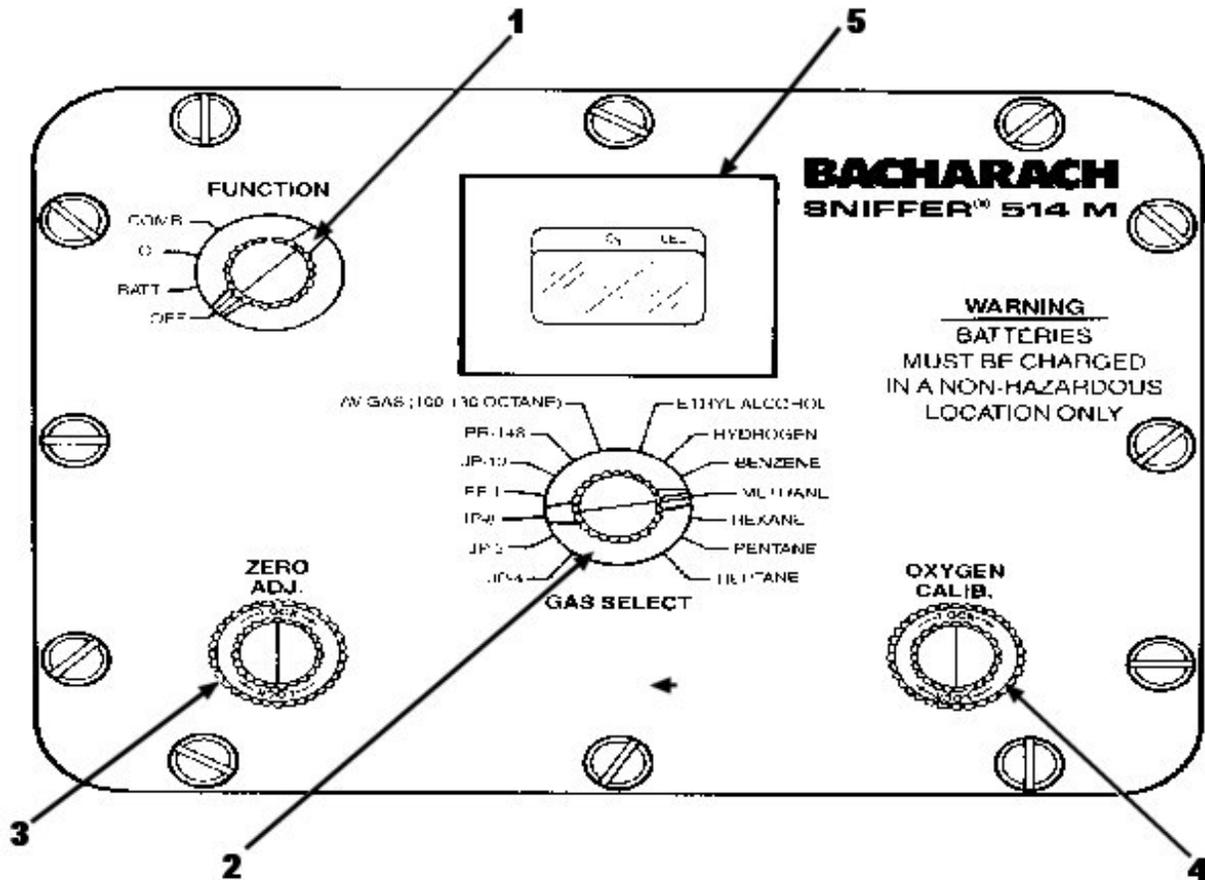
## USE VAPOR/OXYGEN INDICATOR

**1. Background:** Prior to the invention of the BACHARACH 514M indicator, miners, oil field workers, and other people who worked in hazardous, explosive atmospheres depended on their nose. Later, other types of crude vapor indicators were available besides the nose, but today they would probably horrify the Humane Society. Some of these antiquated methods were mice and birds placed in suspected hazardous areas. If they lived, those areas were assumed safe; but if they died, you waited a little while longer, or ventilated. Therefore, the importance of this piece of equipment has evolved for your safety.

**1.1.** Technical Order 11H5-35-1 was used for the development of this AFQTP. The indicator is a portable hazardous vapor monitor designed to detect toxic and combustible levels of gases and vapors. The unit is used to sample atmospheres in confined spaces before and during entry by maintenance or inspection personnel. The concentration of gas or vapor is displayed in percent of lower explosive level (% LEL) on a liquid crystal display (LCD). The indicator also measures oxygen concentration. Audible and visual alarms are provided to warn the operator of impending hazardous conditions.

**1.2.** Before using the indicator, ensure that it has been calibrated and that the calibration is current. There should be a calibration label attached to the monitor certified by PMEL. Perform an inspection on the associated hoses and fittings, looking for cracks and obstructions. Familiarize yourself with the controls and indicators as seen in Figure 1 below. The purpose of an operational checkout is to determine whether the alarm is able to properly perform its mission. (See Figure 1 for description of components.)

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Component	Function
1. FUNCTION switch.	Turns indicator on and off. Selects variable to be displayed on LCD.
2. GAS SELECT switch.	Selects the type of combustible gas or vapor to be detected.
3. ZERO ADJ. Potentiometer.	Sets reference voltage for zero meter reading in combustible-free environment.
4. OXYGEN CALIB. Potentiometer	Sets reference level for oxygen concentration in normal environment.
5. Liquid crystal display (LCD).	Displays battery voltage level, oxygen concentration, or % LEL continuously, depending on FUNCTION switch setting. Displays error code in event of component failure. Provides visual indication in case of alarm condition.

Figure 1. Controls and Indicators

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**2. To perform this task, follow these steps:**

**NOTE:**

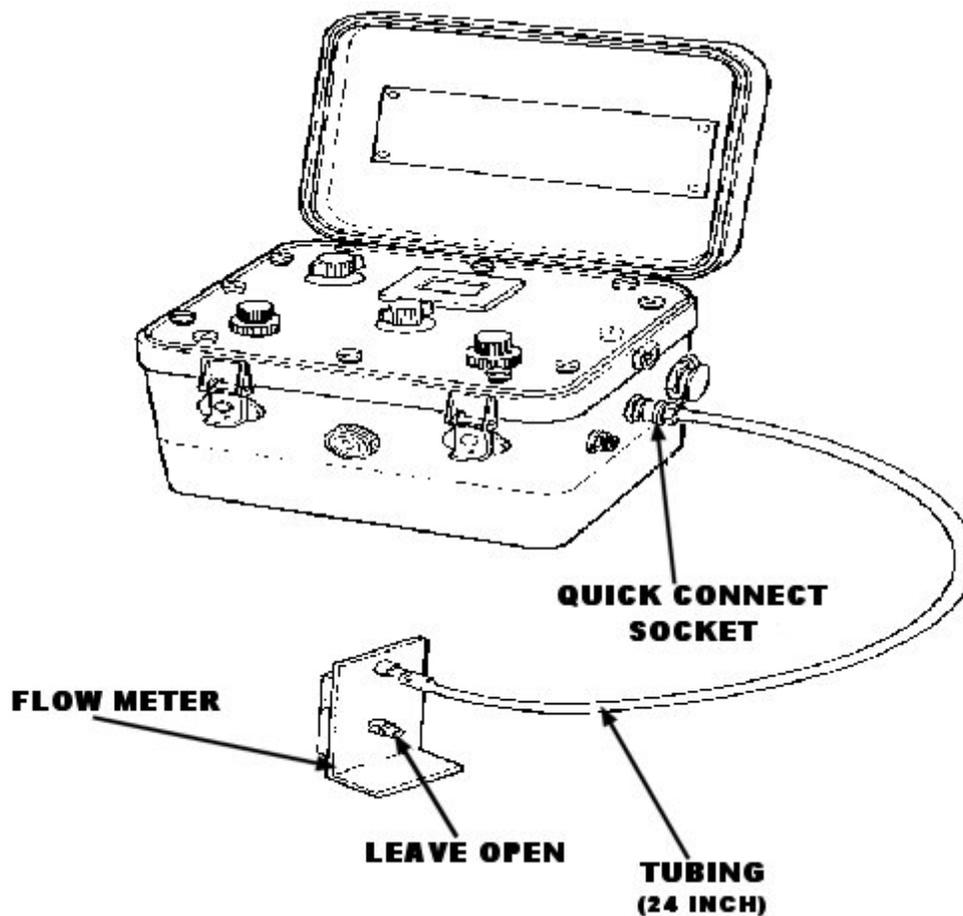
If unit gives error indication, or fails to perform as described during any step of the operational checkout, the unit must be serviced before use.

**Step 1: Check startup.**

- 1.1. Turn indicator on by setting FUNCTION switch to BATT. position.
- 1.2. Check that indicator steps through power on sequence.
- 1.3. Verify that battery voltage is above 5.2 volts.
  - 1.3.1. If voltage indicated is 5.2 volts or less, charge indicator before proceeding.

**Step 2: Check pump flow rate.**

- 2.1. Connect flowmeter to inlet fitting as shown in Figure 2.
- 2.2. If flow indicated is less than 1 scfh, refer to troubleshooting procedures in the technical manual.



**Figure 2. Flowmeter Setup**

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**Step 3: Check alarms.**

- 3.1. Set FUNCTION switch to O<sub>2</sub> position and observe display until stable indication is given.
- 3.2. Loosen lock ring on OXYGEN CALIB.
- 3.3. Potentiometer, adjust for indication less than 19.5 %, verify audible and visual alarms.
- 3.4. Adjust potentiometer to 20.9%, verify alarms deactivation, tighten lock ring.
- 3.5. Set GAS SELECT switch to METHANE position, connect drying tube to indicator.
- 3.6. Set FUNCTION switch to COMB.
- 3.7. Position and observe display until stable.
- 3.8. Loosen lock ring on ZERO ADJ. Potentiometer, adjust until display is 0, tighten ring.
- 3.9. Assemble calibration components as seen in Figure 3 using methane calibration gas.
- 3.10. Open gas valve, if less than 50 psi replace calibration tank.
- 3.11. Ensure there is positive flow on the flow meter at all times during checkout.
- 3.12. Verify that display indicates a reading of 0 – 5% above the rating for the calibration gas and that alarms are given.

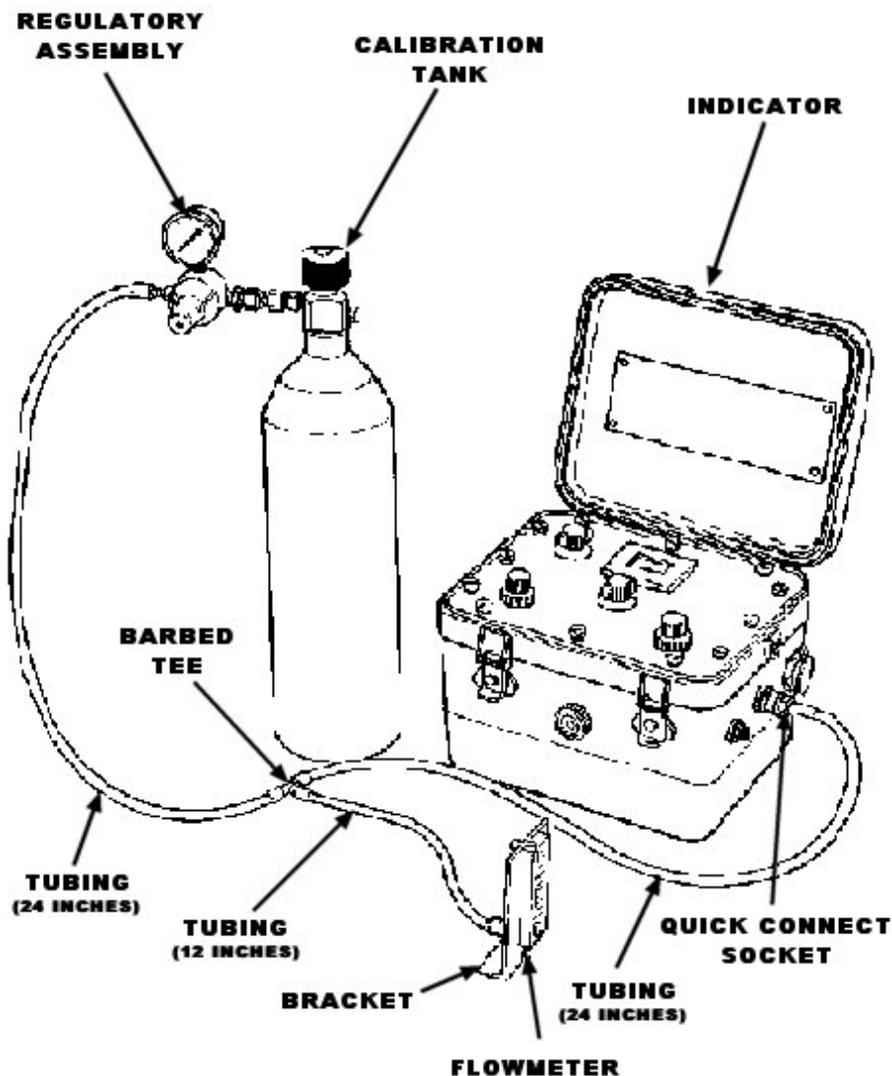


Figure 3. Calibrator Setup

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**Step 4: Verify Oxygen Cell.**

- 4.1. Connect 24-inch tubing; you need to blow into the tube for 10 seconds, to lower oxygen level.
- 4.2. If no reduction in reading, see technical manual for troubleshooting.
- 4.3. Disconnect tubing.
- 4.4. Indicator is now ready for use.

**NOTE:**

Steps 1-4 complete the operational check. The remaining steps are for normal operations.

**Step 5: Normal Startup.**

- 5.1. While still in a fresh air location, connect desired hose assembly and probe to indicator (See Figure 4).
- 5.2. Turn indicator on by setting FUNCTION switch to BATT. position.
- 5.3. Observe display and ensure the LCD accomplishes a self-test (Indicator should display triple 0 thru triple 9 then triple -, E, H, L, and P).
- 5.4. Errors during the self-test are indicated by displaying an error message (for example: E-1) and should be referred to the technical manual.
- 5.5. Verify that battery voltage is above 5.2 volts. If voltage indicated is 5.2 volts or less, charge indicator before proceeding.

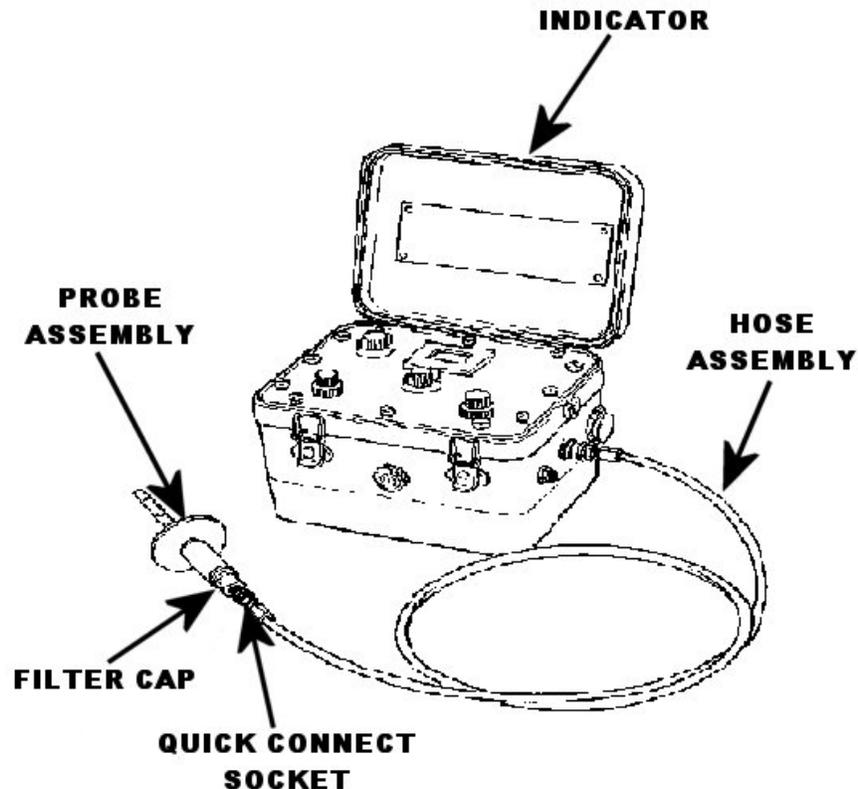


Figure 4. Normal Operation Setup

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**Step 6: Set O<sub>2</sub> Setting.**

- 6.1. Set FUNCTION switch to O<sub>2</sub> position and observe display until stable indication is given.
- 6.2. Loosen lock ring on OXYGEN CALIB.
- 6.3. Potentiometer, adjust for indication less than 20.9 %, tighten lock ring.

**Step 7: Select Vapor to be tested.**

- 7.1. Set GAS SELECT switch to combustible gas or vapor to be detected.

**NOTE:**

If type of gas to be detected is unknown, set indicator for JP-5.

**Step 8: Zero readings.**

- 8.1. Set FUNCTION switch to COMB. Position and observe display until stable. Loosen lock ring on ZERO ADJ. Potentiometer, adjust until display is 0, tighten ring.

**Step 9: Begin testing area.**

- 9.1. Set FUNCTION switch to variable to be displayed.
- 9.2. Insert probe into area and draw a sample for 30 seconds or until a stable indication is observed.
- 9.3. Indicator maybe used to sample continuously for 10.5 hours on a full charge.

**SAFETY:**

**DO NOT IMMERSE THE PROBE INTO LIQUID.**

**Step 10: Shutdown.**

- 9.1. At the end of sampling operation, sample from a gas free area for 10 seconds to purge indicator.
- 9.2. Set Function switch to Batt. position and verify voltage is above 5.2.
- 9.3. Set FUNCTION switch to OFF position. If voltage was below 5.2, charge indicator for next use.

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**REVIEW QUESTIONS  
FOR  
USE VAPOR/OXYGEN INDICATOR**

QUESTION	ANSWER
1. In what units is the concentration of vapors displayed on the vapor/oxygen indicator?	a. Gallons. b. % LEL. c. Gallons per minute (gpm). d. % PPM.
2. Before using the meter you must ensure what?	a. The lights are working. b. Batteries are installed. c. Calibration is current. d. Vapors are present in the area.
3. What does the FUNCTION switch do?	a. Select the type of gas to detect for. b. Zero the O <sub>2</sub> reading. c. Turn the indicator on and off. d. Turn the indicator off.
4. What voltage must the battery have to use the vapor/indicator?	a. < 5.2. b. 5.2. c. <5.0. d. >5.2.
5. Which switch is turned to check the battery voltage level?	a. FUNCTION switch to level check. b. FUNCTION switch to Battery. c. GAS SELECT switch to level check. d. GAS SELECT switch to Battery.
6. What do you set the vapor/oxygen indicator GAS SELECT switch to if the vapor being detected is unknown?	a. JP-5. b. JP-4. c. Methane. d. Benzene.
7. When taking a sample, what is the minimum time you should allow the indicator to draw in a sample of the atmosphere?	a. 10 sec. b. 15 sec. c. 20 sec. d. 30 sec.

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**USE VAPOR/OXYGEN INDICATOR**

**PERFORMANCE CHECKLIST**

**INSTRUCTIONS:**

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

<b>DID THE TRAINEE....?</b>	<b>YES</b>	<b>NO</b>
1. Observe startup sequence		
2. Check pump flow rate		
3. Verify Oxygen alarm		
4. Verify LEL alarm		
5. Check O <sub>2</sub> cell		
6. Check assembled meter for normal sampling		
7. Set O <sub>2</sub> setting		
8. Select vapor to be detected		
9. Check for zero reading		
10. Properly sample area for 30 seconds		
11. Follow proper shutdown procedures and purge indicator for 10 seconds in a gas free area		

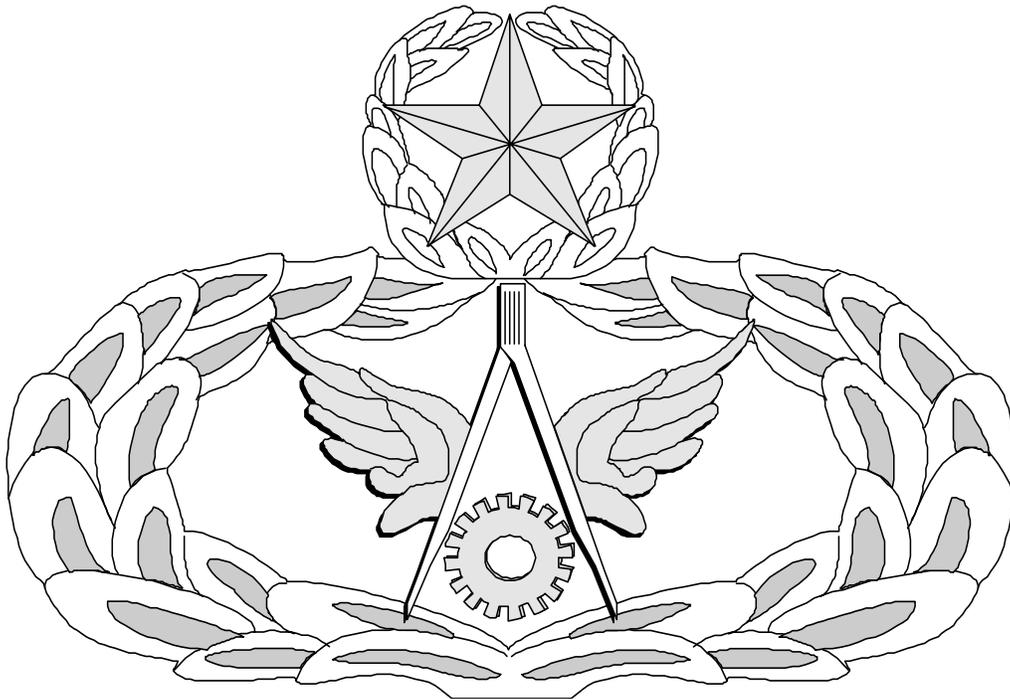
**FEEDBACK:** Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

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# Air Force Civil Engineer

## QUALIFICATION TRAINING PACKAGE (QTP)

### REVIEW ANSWER KEY



FOR  
LIQUID FUEL SYSTEMS MAINTENANCE  
(3E4X2)

MODULE 12

TOOLS AND EQUIPMENT

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**Key-1**

**USE VAPOR/OXYGEN INDICATOR  
(3E4X2-12.4.)**

QUESTION	ANSWER
1. In what units is the concentration of vapors displayed on the vapor/oxygen indicator?	b. % LEL.
2. Before using the meter you must ensure what?	c. Calibration is current.
3. What does the FUNCTION switch do?	c. Turn the indicator on and off.
4. What voltage must the battery have to use the vapor/indicator?	d. >5.2.
5. Which switch is turned to check the battery voltage level?	b. FUNCTION switch to Batt.
6. What do you set the vapor/oxygen indicator GAS SELECT switch to if the vapor being detected is unknown?	a. JP-5.
7. When taking a sample, what is the minimum time you should allow the indicator to draw in a sample of the atmosphere?	d. 30 sec.

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MEMORANDUM FOR HQ AFCESA/CEOF  
139 Barnes Drive Suite 1  
Tyndall AFB, FL 32403-5319

FROM:

SUBJECT: Qualification Training Package Improvement

1. Identify module.

Module # and title \_\_\_\_\_

2. Identify improvement/correction section(s):

- |  |  |
|--|--|
| <input type="checkbox"/> STS Task Reference        | <input type="checkbox"/> Performance Checklist |
| <input type="checkbox"/> Training Reference        | <input type="checkbox"/> Feedback              |
| <input type="checkbox"/> Evaluation Instructions   | <input type="checkbox"/> Format                |
| <input type="checkbox"/> Performance Resources     | <input type="checkbox"/> Other                 |
| <input type="checkbox"/> Steps in Task Performance |  |

3. Recommended changes--use a continuation sheet if necessary.

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4. You may choose to call in your recommendations to DSN 523-6380 or FAX DSN/Commercial 523-6488 or (850) 283-6488 or email [ceof.helpdesk@tyndall.af.mil](mailto:ceof.helpdesk@tyndall.af.mil).

5. Thank you for your time and interest.

YOUR NAME, RANK, USAF  
Title/Position